NATIONAL PLANNING COMMITTEE SERIES

CHEMICAL INDUSTRIES

(Report of the Sub-Committee)

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To

All Those

MEMBERS OF THE NATIONAL PLANNING COMMITTEE

and of

Its Various Sub-Committees

A TRIBUTE OF APPRECIATION

प्रारब्धमुत्तमजना न परित्यजन्ति

PERSONNEL OF THE CHEMICAL INDUSTRIES

SUB-COMMITTEE

Chairman

Dr. J. C. Ghosh, D.Sc.,

Secretary

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Shri Satya Prasanna Sen.

PREFACE

The National Planning Committee, appointed in 1938, began its work early in 1939. After defining the nature of a National Plan, and determining the nature and scope of the work entrusted to them, the Committee issued an elaborate and comprehensive questionnaire which was subsequently supplemented by specific details. Twenty-nine Sub-Committees, formed into eight groups were set up with special terms of reference to deal with all parts and aspects of the national life and work in accordance with a predetermined Plan.

After some unavoidable delay in getting replies to the Questionnaire, the Sub-Committees began their work, and submitted Reports,—some of them Final, some Interim,—which were considered at Plenary Sessions of the parent Committee in 1940. Towards the end of that year the Chairman, Pandit Jawaharlal Nehru, was arrested and sentenced to a long term of imprisonment, during which the work of the Committee had necessarily to be suspended.

On his release a year later, hope revived for an intensive resumption of the Committee's work. But the outbreak of war with Japan, the threat to India's own safety, and hectic march of political events, rendered it impossible to devote any attention to such work at that time. It, therefore, inevitably went into cold storage once again; and remained for the duration of the War.

When at last the War seemed nearing its end, Pandit Jawaharlal Nehru with other leaders was released. The moment seemed again opportune to resume the work of the Planning Committee. Meetings of that Body were held in September and November 1945, when certain more urgent questions, already included in the programme of National Planning were given a special precedence. A Priority Committee was appointed to report upon them. Changes and developments occuring during the War had also to be taken into account; and another Committee was appointed to review the general instructions, given six years earlier to the Sub-Committees. Revised instructions were issued to them following the Report of this Sub-Committee; and the Chairmen and Secretaries of the several Sub-Committees were once again requested to revise and bring, up to date, such of the Reports as had already been submitted —either as final or interim—while those that had not submitted any reports at all were asked to do so at an early date.

As a result, many of the Sub-Committees which had not reported, or had made only an Interim Report, put in their Reports, or finalised them. The parent Committee has had no chance to review them, and pass resolutions on the same. But the documents are, by themselves, of sufficient value, prepared as they are, by experts in each case, to be included in this series.

The following Table shows the condition of the Sub-Committees' work, and the stage to which the Planning Committee had reached in connection with them.

Serial No.	Name of the Sub-Committee	Final Report		Interim Report		No Reports
		N. P. C. Resolutions	Not considered by N.P.C.	N. P. C. Resolution	Not considered by the N.P.C.	
Group I.	**Agriculture and Sources of Primary Production**	Handbook Pp.		Handbook Pp.		
1.	Rural Marketing and Finance	97—99				
2.	River Training and Irrigation Part I	83—85				
	,, ,, ,, Part II	113-115				
3.	Soil Conservation and Afforestation	115-119				
4.	Land Policy and Agriculture			139-141		
5.	Animal Husbandry and Dairying	87—89				
6.	Crop Planning and Production					
7.	Horticulture	102-103			do	do
8.	Fisheries		do			
Group II	**Industries or Secondary Sources of Production**					
1.	Rural and Cottage Industries		do			
2.	Power and Fuel					
3.	Chemicals					
4.	Mining and Metallurgy			77—79		
5.	Engineering Industries	75—77		130-133		
6.	Manufacturing Industries		do		..	
7.	Industries connected with Scientific Instruments		do			
Group III	**Human Factor**					
1.	Labour	89—92				
2.	Population	85—87				
Group IV	**Exchange and Finance**					
1.	Trade					do
2.	Industrial Finance			130		
3.	Public Finance					
4.	Currency and Banking			122-126		
5.	Insurance			93—95		
Group V	**Public Utilities**			95—97		
1.	Transport ..					
2.	Communications	126-129		120-122		
Group VI	**Social Services-Health and Housing**					
1.	National Housing					
2.	Public Health	99-100				do
Group VII	**Education**					
1.	General Education			133-139	do	
2.	Technical Education				do	
Group VIII	**Women's Role in Planned Economy**					

To sum up, fourteen Sub-Committees had made final reports, of which ten have been considered, and Resolutions taken upon them, by the National Planning Committee. Twelve more have presented Interim Reports, of which nine have been considered by the Planning Committee, with Resolutions thereon, while three Sub-Committees have not yet presented any report on the reference made to them.

The idea that all this material, gathered together with the help of some of the best brains in India in the several departments of our national life, should be printed and published was before the Committee from the start. But the interruption caused by the war prevented its realisation. It was once again mooted in 1941 ; but the moment was not deemed ripe then for such action, partly because the leading spirits in almost every one of the Sub-Committees were unable to devote time and labour to bring their Reports up-todate ; and partly also because war-time restrictions or shortages had made scarcer than ever before the statistics and other facts, which particular sub-committees would need, to bring their work up-to-date. The War time needs of Government had attracted several of them to work on Government Bodies, Panels, or Committees. For all these reasons it was seemed undesirable that material of this character—valuable as it must be—should be put out in an incomplete, inchoate, obsolete form, which may reflect unfavourably upon Indian capacity for such tasks.

The four last years of the War were thus a period of suspended animation for the National Planning Committee. Even after the end of the war, it has not been feasible for obvious reasons, for the Planning Committee to resume its work and finalise decisions. Continuous Sessions of that body are indispensable for considering and taking decisions on the Sub-Committee reports presented since 1940, and putting all the material into shape, ready for publication, not to mention making its own Report; but the political situation in the country made it impossible. Other conditions, however, are somewhat more favourable than in 1938-39, when the Central Government of the country were all but openly hostile to such attempts. Lest, however, the momentary difficulties make for needless further delay, it was thought advisable by the Chairman and the undersigned that no more time should be lost in putting this material before the Public. Following this advice, it is now proposed to bring out a complete Series of the National Planning Committee's Sub-Committee Reports, which will serve as appendices to the Parent Committee's own Report. The Plan of the proposed enterprise is briefly summarised below.

Every Sub-Committee's Report, which is in a final form and on which the National Planning Committee has itself taken resolutions, will be edited and published, with an Introduction assigning their due importance to the suggestions and recommendations contained in that particular report, its proper place in the over-all National Plan; and following it up, wherever necessary, by a kind of Epilogue, summarising the developments that have taken place during the seven years, during which the work of the Planning Committee had been in suspension.

Those Reports, again, which, though in a final form, have not yet been considered, and no resolutions taken thereon, by the Plannings Committee, will also be included in the Series in the form in which they were submitted, with such Introduction and Epilogue to each as may be deemed appropriate. And the same treatment will be applied to Reports which are 'Ad Interim', whether or not the parent Committee has expressed any opinion on the same. They will be finalised, wherever possible, in the office, with such aid as the Chairman or Secretary of the Sub-Committee may be good enough to render. Sub-Committees finally, which have not submitted any Report at all,—they are very few,—will also find their work similarly dealt with. The essence, in fine, of the scheme is that no avoidable delay will now be suffered to keep the National Planning Committee's work from the public.

Both the Introduction and the Epilogue will be supplied by the undersigned, who would naturally be grateful for such help as he may receive from the personnel of each Sub-Committee concerned. The purpose of these addition is, as already stated, to assign its true place to each such work in the overall Plan; and to bring up the material in each Report to date, wherever possible.

Not every Sub-Committee's Report is sufficiently large to make, more or less, a volume by itself, of uniform size, for this Series. In such cases two or more Reports will be combined, so as to maintain uniformity of size, get-up, and presentation of the material. The various Reports, it may be added, would not be taken in the order of the classification or grouping originally given by the Planning Committee; nor even of what may be called the intrinsic importance of each subject.

In view of the varying stages at which the several Reports are, for reasons of convenience, it has been thought advisable to take up for printing first those which are final, and on which the Planning Committee has pronounced some resolutions. Printing arrangements have been made with more than one Press, so that

two or three Reports may be taken simultaneously and published as soon as possible so that the entire series may be completed in the course of the year.

Two other Sub-Committees not included in the list of Sub-Committees given above, were assigned special tasks of (1) preparing the basic ideas of National Planning; and (2) outlining the administrative machinery deemed appropriate for carrying out the Plan. These were unable to function for reasons already explained. The present writer has, however, in his personal capacity, and entirely on his own responsibility, published the "Principles of Planning" which attempts to outline the fundamental aims and ideals of a National Plan which remains to be considered by the Planning Committee. Similarly, he has also attempted to sketch an administrative machinery and arrangements, necessary to give effect to the Plan, when at last it is formulated, and put into execution. Notwithstanding that these two are outside the Scheme outlined in this Preface, they are mentioned to round up the general picture of the arrangements made for publication of the entire work up-to-date of the National Planning Committee and its several Sub-Committees.

The several volumes of Sub-Committee Reports, when published, will be treated as so many appendices to the Report of the parent body, the National Planning Committee. It is impossible to say when that Committee, as a whole, will be able to hold continuous sessions, review and resolve upon Sub-Committee Reports which have not yet been considered, and lay down their basic ideas and governing principles for an all over Plan, applicable to the country, including all the facts of its life, and all items making up the welfare of its people.

The disturbed conditions all over the country, and the Labour unrest that has followed the end of the War has caused unavoidable delays in printing and publishing the several volumes in the series, which, it is hoped, will be excused.

In the end, a word of acknowledgment is necessary to put on record the aid received by the Editor in the preparation and publication of this Series. All those who are associated in the task,—members of the Parent Committee, or as Chairmen, Secretaries or Members of the various Sub-Committees, have laboured wholly, honorarily, and consistently striven to give the best that lay in them for the service of the country. Almost all Provincial Governments and some States,—the latter twice in some cases,—have made contributions towards the expenses of this office, which have been acknowledged and accounted for in the Handbooks of the Planning Committee, published earlier.

Suitable appreciation of these will be expressed when the Parent Committee makes its own Report. At almost the end of its task, the expenditure needed to edit, compile, and otherwise prepare for the Press, the several Reports, has been financed by a Loan by Messrs. Tata Sons Ltd., which, even when repaid, will not diminish the value of the timely aid, nor the sense of gratitude felt by the undersigned.

Bombay,
1st July, 1947.

K. T. Shah

CONTENTS

INTRODUCTION

The Chemical Industries Sub-Committee, appointed by the National Planning Committee, consisted of :—

Dr. J. C. Ghosh (Chairman)

Shri B. D. Amin	Dr. N. R. Damle
Dr. K. Venkatraman	Dr. Qudrat-i-Khuda
Dr. S. S. Bhatnagar	Prof. D. Y. Athavle
Dr. N. N. Godbole	Dr. B. K. Nandi
Shri M. L. Dey	Dr. Mata Prasad
Shri Rajshekhar Bose	Dr. K. G. Naik
Shri S. G. Shastry	Dr. P. C. Guha
Dr. B. C. Guha	Mr. M. P. Kanga
Shri Kapilram H. Vakil	Dr. R. L. Datta

Prof. R. C. Shah (Secretary)

with the following Terms of Reference :—

(a) "to make a census of chemicals, including fertilisers, produced in India, and imported from abroad;

(b) to survey the potentialities for the manufacture of chemicals in India.

(c) to form an estimate of the country's requirements in chemicals on a progressive scale for the next ten years.

(d) to recommend ways and means for developing chemical industries in order to supply the Nation's requirements in the next ten years.

(e) to recommend such legislation or special concessions as may be necessary for the encouragement or development of these industries.

(f) to review the possibility of Export Trade in chemicals for the manufacture of which India possesses special advantages."

Soon after its formation, the Sub-Committee met, and devised machinery for collecting information and gathering data. These, however, have not been secured to the extent the Sub-Committee would have desired. Like all other items in such enquiries, the statistical and factual material in this country, officially collected and published, is very poor; while that obtainable from private sources is neither authoritative nor abundant, Dealers and manufacturers are reluctant to answer enquiries of

this kind even by such an Organisation as the National Planning Committee ; and hence the paucity of the material. The Sub-Committee is thus obliged to complain in almost every section of its Report about the lack of the necessary data; and the Report, necessarily, suffers from want of the requisite material in consequence.

The Report is, as already stated, an Interim document, which would have been finalised, had the National Planning Committee continued to function actively, and the Sub-Committee been given sufficient time to finalise its recommendations. As it is, its conclusions and recommendations cover a goodly ground, and appear to provide sufficient ground for assessing the importance of the Chemical Industry, and recognising its proper place in an all-round National Plan.

From the outset, the National Planning Committee had recognised the vital importance of the Chemicals Industry by listing it in the Group of Key Industries, i.e. Industries which are vital to the very existence of the country, or which are the parent or foundation of other important industries.

This importance was also recognised, in all its varied aspects, by the Government of India, when they at last awoke to the necessity of planning, both to meet the urgent war needs and also to provide for post-war development. The Planning and Development Department had set up at least three of its twenty-nine Panels to consider :—

1) The Electro-Chemical Industries;
2) The Heavy Chemical Industries ; and
3) The Dye-stuffs Exploratory Committee;

and some of the leading Members of the National Planning Committee's Sub-Committee were closely associated with these Panels.

In four essential aspects of our national economy, this Industry is of the utmost importance, and fully deserves its description as a Key or Parent Industry on which other industries are dependent.

I. DEFENCE NEEDS

1. In the first place, the Chemicals Industry in its several branches, forms the backbone of the entire provision for the Defence of a country in modern times. This is no longer an age of thews and sinews, nor even of bows and arrows. It is an age where the Atom Bomb is the decisive factor. Wars will be fought and won, not by mere weight of numbers, but by the fullness, variety and up-to-date character of the supplies and armaments, which only a highly industrialised country can provide. All kinds of ammunition, explosives, gases, etc., depend upon a well-developed Chemical Industry to supply the country's needs for De-

fence. The Sub-Committee in their Report fully recognise it; and the Panels appointed by Government have also realised this aspect, which was intensified during and because of the War.

Defence needs still continue to be paramount in shaping the industrial organisation of the country. Even if the United Nations' Organisation becomes sufficiently strong to outlaw War altogether from the face of the earth, each member of that Organisation would nevertheless have to make its own contribution towards the policing of the world. The result is that much of the material now devoted to a country's own individual Defence would be needed to meet the obligation of a Member of the United Nations, which cannot be fulfilled unless there was an adequate Chemical Industry in each such country.

The ideal, however, of that Organisation, viz. a wholly warless world, does not seem likely to be realised in the immediate future. Not even the leading members, sponsors or parents of the Organisation, have started discontinuing or even diminishing their own Defence Preparation, whether in actual armament or supporting industry. Without, therefore, being an advocate in any sense whatever of war as the only means for settling international differences, one cannot yet overlook altogether the possibility of aggression from outside for a country like India just starting on its path of National Independence, and the consequent necessity for her to be as much prepared for self-defence as any possible aggressor. Such preparedness would be all but impossible if we have no well-grown Chemical Industry of our own. The Government of India have mainly depended hitherto for such material on foreign imports. The figures collected by the Sub-Committee, and those given elsewhere in this Introduction, are eloquent evidence of that policy of keeping India helplessly dependent on foreign supplies for vital needs of National Defence, which can no longer be tolerated. And that apart from the consideration that details of imports actually on account of the Defence Department are not revealed.

NEEDS STATE AID

This Industry has not its importance only in connection with National Defence, though that alone would suffice to make it imperative on a National Planning Authority to take it immediately in hand and develop it with the utmost rapidity possible. It is of vital importance in normal times also, and as such, the Chemical Industry ought to be under the direct ownership and management by the State. For reasons of Defence as well as regional development, it should be dispersed in such parts of the country as are best suited for the purpose from the point of view of raw materials, cheap power, and other necessary condi- after indicates in some detail the different regions where th's dions. The section on the Location of that Industry given here-

Industry has possibilities for a variety of considerations. In the meanwhile, it must be added that no great vested interests of private enterprise exist; and so the field is relatively clear. If this Industry is a nationalised concern from its start, there would be very little difficulty in distributing or allocating it to regions and localities technically appropriate for the purpose. Difficulties of transport, lack of cheap power, distance or uncertainty of markets, which have impeded the progress of the industry, so far, may then all be easily remedied.

Another consideration in regard to this Industry, and its future development as an integral part of the Plan, arises from the relative backwardness of the country in this regard; and the correspondingly strong position of foreign competitors invading our market and capturing it directly or indirectly, so that the Industry has not much prospect of success, unaided by the State. It is, of course, not possible for this country to decide upon a complete prohibition of all imports of Chemicals, and so shut out the foreign interests competing in the Indian market. The latter are so strong, being parts of World Combines, Trusts, or Syndicates, that they have obtained a practical monopoly of the Indian Market. In the face of this competition, and the vital role of Chemicals in peace and war, the Government of India would not be able to adopt and carry out a rigorous protectionist Tariff Policy against such Combines, if the advantage of such protection goes only to the private owner.

FOREIGN CAPITAL IN ALLIANCE WITH INDIAN

Foreseeing possibilities of strong opposition, however, in a resurgent nationalism, the competing Foreign Combines have changed their tactics. Instead of importing their products entirely, they now try to produce them in this country, in alliance with Indian Capitalists, who will give the enterprise a national character in this country, and so secure the benefit of fiscal protection, if that policy is adopted, and secure for them the full benefit of all forms of State aid. Under the Agreements reported between International Chemical Combines and corresponding Indian Enterprise, the problem of policy, direction and management, has, no doubt, been attended to, so that those interested may claim to have safeguarded the national interests in this arrangement to the fullest. They would share all patents and discoveries, all processes and technical advances, so that the necessary pre-requisites for setting up and working the Industry would not be lacking. It is presumed, of course, that this Industry will need full protection and encouragement if it is to be properly built up to make the country as nearly self-sufficient as possible. Such aid and protection, however, would go to private parties at the cost of the community. It must thus be a matter of crucial economic policy for the rulers of this country to decide

if they would admit, in this disguised manner, foreign capital and enterprise, in alliance with Indian enterprise, in such a vital industry necessary for the very existence of the country itself; or whether we should be determined enough to establish **a complete State Monopoly** in this Industry, owned and managed by the State or its delegate, to be established and built up till all the requirements of the country for Defence and civil needs are met from the country's own production of Chemicals, unalloyed by any foreign association.

As stated in the Interim Report, the country is by no means poor in regard to basic raw materials, technical skill, and other pre-requisites for the successful establishment of this Industry. Advanced scientific research may be lacking, though even in that regard, according to some of the suggestions in the last Sessions of the Science Congress, the scientifically trained man-power in this country, if not of the very highest, at least of sufficiently advanced character, is so large that all the reasonable needs of technical skill may well be met from our own resources. And if a deficit is still left, technical skill of this kind would not be difficult to obtain from the more advanced countries like Germany, America, Russia or Japan.

Lack of electrical energy may be a temporary handicap; but that can be remedied easily when once a comprehensive Plan is set into operation. The problem of suitable market for the products of the industry is a question only of correct location of the industry; and that, as already mentioned, would be no difficulty if the Industry is worked as an integral part of the National Plan, and is owned and managed by the State as a Key or Defence Industry.

Neither on account of lack of essential raw materials, therefore, nor lack of technical skill, need this Industry by impossible to establish in this country. The capital needed may be considerable; but if the State is running the Industry, that would be no insuperable difficulty.

II. PARENT INDUSTRY FOR OTHERS

2. The second reason why this is regarded as a Key Industry of vital importance to the country, lies in the fact that it is the basic Industry to provide artificial Fertilisers, which are needed for this country's largest single Industry, offering the largest volume of employment to the largest proportion of the people, and producing the major proportion of the wealth of the country, namely, agriculture. It is almost a truism to say that Agriculture in this country is very backward, in point of yield per unit, as also the quality of the yield. This can be very easily rectified by improvements in the accessories of agriculture, such

as adequate and regular water-supply by irrigation works where rainfall fails, suitable manure, better implements and seed, and the like. It is unnecessary at this stage to enter into the question of social, organisational and other factors, like the excessive fragmentation of land in this country, which handicap that industry to a very large degree, and reduce and impoverish the yield per unit to much below what it may well be expected.

But even when these factors are reconditioned, the **morcellement** of agricultural land is stopped, and economic units provided, the inherent qualities of the soil would still require attention and nourishment that organic manure and artificial Fertilisers can afford on a large enough scale to be entirely satisfactory. It has been calculated that Indian Agriculture to be fully rehabilitated, so to say, would require something like a million tons of such Fertilisers. A start has been made by a factory estimated to produce some 350,000 tons; while smaller plants are in operation in Mysore and Travancore which will go some way to meet the deficit. But to make up the full quota, and even to stimulate agriculture still further, a full-sized Chemical Industry, as an integral part of the Plan, is indispensable. Some criticism has, no doubt, been urged upon the newly projected Fertiliser Plant in regard to its production or outturn, as also on the score of its initial financing, pricing of its products, and other analogous. reasons. Whether or not this criticism is well-founded lies in the future. For the moment it is important to add that, quite apart from technical or financial objections that could be urged against these attempts, the fact must be recognised that the success of the Fertilisers Industry depends in a very large measure upon the existence in the country of a fully developed Chemical Industry.

III. INDISPENSABLE ACCESSORY FOR OTHER INDUSTRIES

3. A third reason to classify this as a Key Industry is to be found in its being an indispensable accessory for the finished products of several other industries. The dyes and colours, for example, needed for all the textile goods; the paints and varnishes needed in the household furniture and building materials; glass and plastics; oils, soaps and toilette goods; acids and alkalies of all kinds; and other products which are necessary for several other industries, will not be available in the land if there is no adequate Chemicals Industry in the country.

The Report makes a good survey of these several industries in which chemical products are needed. It indicates the present dependence of this country on foreign imports in these respects, and also the possibility of the country replacing such foreign

imports by its own production if only we went about the matter in a thoroughly scientific manner. The Table on page 9 and the following pages makes this evident at a glance.

IV. NECESSARY FOR PUBLIC HEALTH

4. The last but not the least of the reasons compelling the grading of this as a Key Industry, relates to Public Health. The manufacture of drugs, vaccines of all kinds, sera or medicines is part of the Chemical Industry, which would help combat disease and even to prevent it, and maintain the health of the people at a high level. A section is devoted in the Interim Report to that subject; and the Planning Committee has not failed to recognise its importance in its own Resolutions.

The investigations and reports of the Panels appointed by Government have also emphasised most of these considerations. The case for an early establishment of the Chemical Industry in this country on a scale sufficient to meet all our needs in the several categories is irresistible.

MUST BE STATE MONOPOLY

If the Industry is State-owned and State-managed, its distribution or diffusion in all parts of the country naturally suited for its Location will be automatically attended to. As there will then be no scope for any private individual or corporation profiting at the expense of any other Province, little occasion will be left for inter-provincial jealousies, which make the task of locating industries in really suitable places more than ever difficult and delicate. Provinces on the sea coast, where salt can be made from brine, or in those where salt is available, or where coal is abundant would, other things being the same, be the most suitable locations for this Industry in its several Branches. So far as Drugs and Medicines are concerned, Provinces with good forest wealth would, similarly, be best adapted for that purpose, as also for Essential Oils, Paints and Varnishes.

In the problem of organising this Industry, the economies of large-scale production and facility in manufacturing by-products, makes it desirable, for purely technical reasons, to concentrate, rather than disperse, establishments of this Industry. At the present time there are two groups of regions, namely the 24 Parganas in Bengal, and Okhamandal in the Baroda State on the Arabian Sea Coast, which appear to be the biggest concentrations. The former accounts for 40 per cent and the latter for 26 per cent of the total workers employed in this Industry. The choice of Bengal has been influenced, no doubt, by the near availability of coal, and the presence of a considerable market in jute and other industries taking up the products of the Industry.

Likewise in Okhamandal, the presence in a good quantity of the raw material on the spot is the chief reason of the industry being concentrated there. Its principal market is also not far, —the cotton industry in Ahmedabad, Bombay and Sholapur. The products can be sent cheaply to Bombay by sea; and the railway freight to Ahmedabad or Sholapur is by no means prohibitive.

Another Province, with great possibilities for the Chemicals Industry is the Punjab, with its immense salt resources in the Khewra mines. The Imperial Chemicals have got a long lease of 50 years for utilising these raw materials suitable for a large sized Chemical Industry concentrating around the Khewra Salt Mines. The agreement for giving a long-term Monopoly to this Foreign Syndicate is particularly objectionable, because it not only entitles that single Corporation to develop the immense raw materials available there, but allows it to prevent others from doing so, even when it does not choose to develop the appropriate Industry itself. That agreement provides an object lesson to Indian Statesmen, not only in regard to concessions to foreign capitalists at the expense of the country's natural wealth, and future economic development; but also in regard to the danger of Monopolies to private individuals or profit-seeking Corporations, whether Indian or Non-Indian.

Due to reasons of International competition, there has been all the world over a tendency for large sized Industries to gravitate towards a virtual monopoly; and a consequent intensive concentration of the main Industry as well as all subsidiary and connected industries. So long as these are a virtual monopoly in private hands, the economic life of the country will be at the mercy of these private profit-seekers, whether from the point of view of defence or of peace time national self-sufficiency in all Key and vital industries.

Nothing can be more undesirable, in the long-term interests of the country, than such consummation. In view of the vital importance, already stressed and explained, of this Industry, it is to be hoped that none but the State will be allowed to develop this enterprise even as a virtual monopoly, so as to attend justly to all the needs of all the parts of the country.

BEGINNING OF THIS INDUSTRY IN INDIA

The development of the modern, large-scale Chemical Industry in India is relatively of a very recent origin. Except for the Imperial Chemicals and their Associates, there are no great vested interests, nor traditions of private enterprise, which could stand in the way of a sound, scientific, all-round, and well distributed Chemical Industry being established as a Public Monopoly. Its distribution, also in suitable proportions throughout the

country, strictly in accordance with appropriate technical considerations, is a relatively easy task. At the time of the first World War, this Industry was almost non-existent in India. Because of the difficulties of Overseas Transport due to submarine menace, lack of shipping, and conversion of that Industry in the supplying countries to munition production at home, stocks of Chemicals were exhausted, and supplies almost disappeared. The war effort of India was hindered in consequence. Wiser by that experience, it was thought desirable to set up wherever possible this Industry.

By 1939 a good beginning had, no doubt, been made, as the figures given in the body of the Interim Report in its several sections will show. Concentration of the Industry in the two named areas, in Okha and Bengal followed, employing between over two-thirds of the total workers engaged in that industry. As already observed, there is very great scope in several other Provinces, like Bihar or the Punjab, still for the intensive growth of this Industry. Technical considerations, however, suggest that for its maximum possible development, it would be best to concentrate these Industries at Centres which are favourably situated in regard to raw materials, communications, power, and markets.

Smaller units, which exist in certain parts of the country at present , are unable to make good their position, because of the high inland cost of transport, particularly on acids. They cannot survive when larger units come into operation as parts of the Plan, and are able to effect a reduction in costs, and market their products at considerably lower rates than prevail today. Whether that section of the Plan, which relates to the Transport Service would determine railway rates or freight charges by road or other forms of more economic tansportation as charges for service, framed on commercial consideration, or as payment for a Public Utility, is a problem for another volume in this Series. Suffice it to add that, however handled, it would have a material bearing on the inception and growth of that Industry.

The Interim Report gives statistics which are almost all obsolete by now. Technical as well as market conditions are radically changed. The cessation of the publication of the two large folio volumes of **Detailed** Statistics of the Sea-borne Trade of India, makes it even now impossible to bring them more up-to-date. The sub-joined Table, however, makes an attempt in that direction, bringing the figures up to 1939-40 ; while six or seven of the more important items in the Chemical Industries are listed separately, and their figures are brought much nearer to date than in the other case.

IMPORT OF CHEMICALS IN THE YEAR 1939-40

Chemical	Quantities in tons	Value in Rs.
Sulphuric Acid	265	47,842
Hydrochloric Acid	29	15,029
Nitric Acid	80	30,210
Sulphur	38,788	45,45,014
Soda Ash	81,049	78,16,453
Bicarbonate of Soda		
Caustic Soda	35,630	72,30,601
Sodium Silicate	921	1,33,857
Sodium Sulphate	1,718	1,26,601
Sodium Sulphide	3,674	7,01,429
Sodium Nitrate	311	8,02,478
Potassium Chloride	105	2,69,824
Potassium Nitrate		
Potassium Dichromate	315	4,41,696
Potassium Chlorate	1,949	11,28,290
Sodium Dichromate	873	10,08,892
Ammonium Chloride	2,110	7,07,644
Anhydrous Ammonia	146	2,18,160
Calcium Carbide	3,535	9,95,085
Bleaching Powder	11,788	17,81,979
Liq. Chlorine	232	1,59,203
Magnesium Chloride	349	22,100
Magnesium Sulphate	185	31,949
Alum	521	1,62,773
Ferrous Sulphate	59	21,009
Copper Sulphate	1,906	7,37,386
Zinc Chloride	1,567	5,20,338
Borax	1,671	4,87,424
Ammonium Sulphate	3,996	6,27,860
Superphosphate	388	2,12,743
Other Phosphates	92	1,60,204
Amm. Phosphate	49	

IMPORT FIGURES OF ORGANIC ACIDS in 1939-40

	Value in Rs.
Acetic Acid	4,65,000
Carbolic Acid	28,000
Citric Acid	2,73,000
Oxalic Acid	2,04,000
Tarteric Acid	2,17,000
Other sorts	5,85,000

CHEMICALS AND TEXTILE AUXILIARIES IMPORTED DURING 1939-40

Chemical	Quantities in lbs.	Value in Rs.
Alizarine dry exceeding 40%	2,835	11,962
Alizarine moist exceeding 20%	1,37,819	1,49,329
Congo-red	5,63,102	5,50,956
Naphthols	8,57,454	23,46,252
Rapid fast colours	1,26,364	7,52,060
Bases	3,33,526	8,83,253
Other salts	8,55,069	15,92,125
Indigo	6,98,359	12,27,759
Vat Dyes Paste	1,65,713	8,02,638
Vat Dyes Powder	6,31,642	98,07,259
Sulphur Black	3,798,823	17,82,336
Metanil Yellow	2,11,163	2,73,876
Auramine	78	132
Rhodamines	——	——
Aniline Salts	2,38,200	1,09,583
Others	3,481,604	77,80,062

EXPLOSIVES

	1938-39		1939-40	
	Quantity in lbs.	Value in Rs.	Quantity in lbs.	Value in Rs.
Blasting Gelatine	4,39,200	3,46,793	2,07,000	1,73,846
Gelignite & Gelatine Dynamite	9,95,500	7,06,122	14,51,350	10,65,705
Other Nitro Compounds	3,97,600	2,37,215	4,09,000	2,48,864
Blasting fuse	7,10,541)	4,46,292	5,86,434)	4,49,198
Coils	2,346,458)		2,125,660)	
Detonators No.	8,747,500	2,26,498	10,717,650	2,77,600
Others	777,872	6,22,625	552,949	4,79,341

EXPLOSIVES AND AMMUNITION FOR SPORTING PURPOSES

Gunpowder	27,525	23,347	25,450	19,848
Smokeless Powder	8,945	10,001	2,160	8,706
Others	51,460	23,197	63,050	31,643
Cartridges fills for shot-guns in nos.	11,813,804	8,14,185	10,206,027	7,26,886
"rifles & others"	3,170,519	1,17,316	2,881,823	1,42,474

FIREWORKS

Fireworks	2,926,351	9,51,720	1,609,740	5,63,291

IMPORTS OF DYES IN INDIA.

Quantity in cwts. Value in Rs.

COCHINEAL.

	1938-39	1939-40	1938-39	1939-40
Bengal	1	—	117	—
Bombay	864	1,106	1,39,309	2,32,381
	1938-39	1939-40	1938-39	1939-40
Sind	—	18	6	959
Madras	1,395	62	11,163	8,796
Total	2,260	1,186	1,50,595	2,42,136

CUTCH & GAMBIER.

	Quantity in lbs.		Value in Rupees.	
	1938-39	1939-40	1938-39	1939-40
Bengal	84,951	75,578	11,90,765	11,17,796
Bombay	3,117	3,546	86,476	99,539
Sind	163	118	3,980	3,537
Madras	2,564	2,920	62,474	61,787
Total	90,795	82,162	13,43,695	12,82,659

COAL TAR DYES. ALIZARINE DRY NOT EXCEEDING 40%

Bengal	280	—	791	—
Bombay	—	—	—	—
Sind	300	—	493	—
Total	580	—	1,284	—

ALIZARINE DRY EXCEEDING 40%

Bengal	10	—	32	—
Bombay	840	1,995	2,366	9,650
Sind	1,120	840	3,129	2,312
Total	1,970	2,835	5,527	11,962

ALIZARINE MOIST NOT EXCEEDING 16%

Bengal	2,576	8,960	1,344	4,848
Bombay	37,296	39,648	15,932	17,568
Sind	19,936	7,616	9,054	3,493
Madras	4,928	3,360	2,055	1,460
Total	64,736	59,584	28,385	27,369

ALIZARINE MOIST OVER 16% NOT EXCEEDING 20%

Bengal	5,712	9,744	3,444	5,931
Bombay	286,326	435,596	1,44,397	3,03,699
Sind	166,992	81,647	87,114	61,468
Madras	99,344	77,319	54,034	42,533
Total	558,374	604,306	2,88,989	4,13,631

ALIZARINE MOIST OVER 20%

Bengal	—	—	—	—
Bombay	74,400	84,171	72,734	1,00,046
Sind	46,460	221,288	46,179	22,722
Madras	127,357	31,360	1,25,631	26,561
Total	248,207	137,819	2,44,544	1,49,329

TOTAL OF ALIZARINE.

	Quantity in lbs.		Value in Rupees.	
	1938-39	1939-40	1938-39	1939-40
Bengal	8,578	18,704	5,611	10,779
Bombay	398,862	561,410	2,35,429	4,30,963
Sind	234,808	112,391	1,45,969	89,995
Madras	231,619	112,039	1,81,720	70,554
Total	873,867	804,544	5,68,729	6,02,291

CONGO RED

Bengal	35,622	26,949	19,376	31,316
Bombay	422,724	517,634	2,22,817	4,97,382
Sind	9,992	10,002	6,373	10,119
Madras	6,046	8,517	5,245	12,139
Burma	—	—	—	—
Total	474,384	563,102	2,53,811	5,50,956

COUPLING DYES OF NAPHTHOL GROUP—NAPHTHOLS.

Bengal	69,344	108,263	1,64,461	2,94,338
Bombay	683,317	673,920	17,53,908	18,42,583
Sind	7,908	758	15,922	1,813
Madras	155,170	74,513	4,05,847	2,07,518
Burma	—	—	—	—
Total	915,739	857,454	23,40,138	23,46,252

RAPID FAST COLOURS (FAST SALTS)

Bengal	2,944	2,932	17,836	17,340
Bombay	134,809	116,732	8,31,430	7,01,908
Sind	1,500	1,150	7,585	5,812
Madras	7,800	5,550	39,175	27,000
Total	147,053	126,364	8,96,026	7,52,060

BASES

Bengal	34,731	62,925	88,622	1,62,908
Bombay	368,512	223,783	7,32,538	6,13,109
Sind	2,661	1,996	16,425	9,583
Madras	89,462	44,822	1,93,269	97,653
Burma	—	—	—	—
Total	495,366	333,526	10,30,854	8,83,253

OTHER SALTS.				
Bengal	55,898	76,762	99,274	1,57,270
Bombay	861,028	738,859	14,98,284	13,59,606
Sind	16,416	2,136	16,922	3,633
Madras	81,370	37,312	1,13,111	71,616
Burma	—	—	—	—
Total	1,014,712	855,069	17,27,591	15,92,125
VAT DYES — INDIGO				
	Quantity in lbs.		Value in Rupees.	
	1938-39	1939-40	1938-39	1939-40
Bengal	13,664	13,440	23,497	20,665
Bombay	516,313	572,931	7,31,716	10,29,920
Sind	88,802	46,682	1,35,102	67,455
Madras	58,146	65,306	84,221	1,09,719
Burma	—	—	—	—
Total	676,925	698,359	9,74,536	12,27,759
CARBAZOLE — BLUE				
Bengal	25,650	14,392	68,437	37,634
Bombay	34,056	36,652	75,615	1,21,938
Madras	24,909	13,241	59,656	35,971
Total	84,615	64,285	2,03,708	1,95,543
OTHER SORTS (PASTE).				
Bengal	1,092	3,808	3,882	9,583
Bombay	132,815	146,883	6,17,666	7,47,941
Sind	—	50	—	387
Madras	22,990	14,972	69,939	44,727
Total	156,897	165,713	6,91,487	8,02,638
OTHER SORTS (POWDER)				
Bengal	63,468	56,295	7,20,609	6,92,869
Bombay	638,576	526,438	81,59,355	85,57,291
Sind	350	250	2,469	1,073
Madras	111,793	48,659	12,25,588	5,56,021
Total	814,187	631,642	1,11,08,021	98,07,259
SULPHUR BLACK				
Bengal	194,656	286,268	60,585	1,27,564
Bombay	2,201,122	2,971,489	4,61,546	14,05,613
Sind	43,162	11,227	7,607	66,955
Madras	199,244	429,839	46,078	1,82,204
Burma	—	—	—	—
Total	2,638,184	3,798,823	5,75,816	17,82,336

METANIL YELLOW

Bengal	29,360	34,120	34,393	49,868
Bombay	115,542	150,169	1,15,731	2,01,549
Sind	24,313	10,044	20,999	9,667
Madras	33,578	16,830	23,232	12,792
Burma	—	—	—	—
Total	202,793	211,163	1,94,355	2,73,876

AURAMINE 15% AND LESS

	Quantity in cwts.		Value in Rupees.	
	1938-39	1939-40	1938-39	1939-40
Bengal	—	50	—	83
Bombay	—	28	—	49
Sind	—	—	—	—
Madras	—	—	—	—
Total	—	78	—	132

RHODAMINE (CARTHAMINES) 15% AND LESS.

Bombay	—	—	—	—
Sind	—	—	—	—
Madras	—	—	—	—
Total	—	—	—	—

ANILINE SALTS.

Bengal	85,627	37,719	30,377	18,554
Bombay	37,666	76,283	12,987	39,926
Sind	46,989	16,800	16,332	12,391
Madras	73,461	107,398	21,041	38,712
Total	243,743	238,200	80,737	1,09,583

OTHER COAL TAR DYES.

	Quantity in lbs.		Value in Rupees.	
	1938-39	1939-40	1938-39	1939-40
Bengal	250,618	250,952	4,35,305	5,93640
Bombay	2,738,404	2,985,042	47,46,638	67,28,871
Sind	132,884	100,056	1,76,050	1,58,104
Madras	162,827	145,554	3,27,534	2,98,447
Total	3,284,733	3,481,604	56,85,527	77,80,062

TOTAL OF COAL TAR DYES.

Bengal	871,252	993,579	17,72,265	22,25,411
Bombay	9,283,746	10,298,253	2,11,95,660	2,42,78,619
Sind	609,785	413,542	5,67,755	4,36,992
Madras	1,258,415	1,124,552	27,95,656	17,65,073
Total	12,023,198	12,829,926	2,63,31,336	2,87,06,125

MYROBALAN EXTRACTS—NIL

	Saffron			
Bengal	—	147	—	1,000
Bombay	10,934	7,042	6,74,657	5,81,529
Sind	—	—	—	—
Madras	—	—	—	—
Total	10,934	7,189	6,74,657	5,82,529
	OTHER SORTS			
Bengal	22,473	23,191	2,55,750	3,15,386
Bombay	9,160	12,382	1,77,263	3,26,029
Sind	257	1,521	2,065	9,967
Madras	7,226	7,149	1,60,500	1,75,286
Total		44,243	5,95,578	8,26,668

TOTAL FOR DYEING & TANNING SUBSTANCES.

	Value in Rupees.	
Bengal	33,25,005	40,87,277
Bombay	2,22,80,729	2,55,27,957
Sind	5,73,806	4,51,455
Madras	52,36,626	60,11,398
Total	3,14,16,166	3,60,78,087

RECOMMENDATIONS IN THE REPORT OF THE CHEMICALS SUB-COMMITTEE.

The Interim Report has gone into considerable detail on the specific terms of the Sub-Committee's Reference; and has made definite recommendations on each, which are summarised below for convenience of reference.

INTRODUCTION

1. We recommend that manufacturing concerns in India should be permitted to carry on their work only under a licence from the State, which should inter-alia provide for the compulsory supply of such information as is demanded by the State with such safeguards as are considered necessary and equitable.

HEAVY CHEMICALS

2. **Sulphur and Sulphuric Acid.** We recommend strongly that a detailed survey of pyrite deposits be made in India at an early date. Failing discovery of suitable deposits of sulphur or pyrites, we recommend that the economic possibility of recovering sulphur or manufacturing sulphuric acid from the following sources be carefully examined:—

(a) **Sulphur from Chalcopyrites:**—from the sulphur dioxide that goes waste in the process of extraction of copper in Singhbhum District.

(b) **Sulphur from Gypsum:**—by utilising Gypsum for cement manufacture and converting the sulphur dioxide evolving therefrom.

(c) **Sulphur from Assam Coal:**—which are reported to contain about 4% sulphur.

3. We recommend that synthetic ammonia plants which will yield at least 15,000 tons of anhydrous ammonia, be put up in the neighbourhood of the coal fields where cheap power and cheap coal are available.

4. We recommend that in view of the difficulties in the way of cheap production of sulphuric acid in India, instead of fixing ammonia as ammonium sulphate for use as a fertiliser, ammonia should be largely converted into nitro-chalk, urea, and ammonium phosphate as fertilisers.

We recommend strongly that field experiments on a statistical basis be immediately started in representative localities of India with a view to ascertaining the value of these fertilisers relating to the growth of sugar cane.

5. We recommend that an expert committee be appointed to select a site for the location of a factory for the manufacture of Bichromate from the chrome ore, sulphuric acid, soda and fuel at the cheapest rate. It is probable that an experimental factory will be set up in the Mysore State.

6. We recommend that the hot springs of all the Volcanic regions in India should be examined with a view to finding out their boric acid content, preliminary to any attempt to produce boric acid in the country.

7. We recommend that investigations should be started on Indian bitterns, with a view to the economic recovery of potassium and bromine, both of which are valuable chemicals. If such an enquiry yields promising results, a site for the erection of a factory for the manufacture of potassium salts and bromine, may be selected in a suitable area.

8. We recommend very strongly that a thorough survey of the deposits of apatites in Singhbhum and other parts of India and phosphatic nodules in Trichinopoly be undertaken with a view to finding out their total availability and also ascertaining if representative samples from different localities have similar composition as that given above. If these indigenous supplies are not adequate, the nearest source of high class phosphate rock will be Christmas Island. If we import phosphate rock from abroad, then it will be necessary to start manufacture of superphosphate and triple super at a port town favourably situated in respect of import of raw materials, and nearness to consuming centres.

9. We also recommend that the question of manufacture of ammonium phosphate should be fully investigated when pro-

blems relating to the manufacture of synthetic ammonia and phosphoric acid have been successfully tackled.

COAL-TAR DISTILLATION AND DYES

10. We recommend that although the recovery of the bye-products of coal distillation is not likely to be profitable under the present circumstances, this industry, as a key industry must be started on as wide a scale as possible, with the required State help and protection in a suitable form.

11. We recommend that 3 million tons of coal should be annually converted, in addition to the 2 million at present distilled for coal tar and ammonium sulphate, into soft coke for domestic consumption by the low temperature carbonisation process.

12. We recommend the immediate establishment of a coal tar dyestuff industry as a matter of such urgent necessity that the fullest resources of the state and the individual must be mobilised for the purpose. In the earlier stages, it may be suggested, the intermediates may even be bought from foreign markets, till a coal tar industry is established in the country.

13. We recommend concentration on the production of the sulphonated oils and of the Gardinal and Lissopol types of wetting agents. The factories for the production of textile auxiliary agents would best be situated in the immediate neighbourhood of cotton mills since vegetable oils and sulphuric acid are both available within a reasonable distance.

FINE CHEMICALS

14. We recommend in connection with Plant for the manufacture of fine chemicals, that separate units be set up, probably for every different type of chemicals. Although due to war conditions, it may not be possible to get these plants from abroad, it appears feasible to build up such small plants in many cases with the help of materials and workmanship available in India. In the case of highly specialised and costly synthetic chemicals and drugs which have to be prepared in small quantities, glass utensils and apparatus can even be conveniently and profitably used.

15. Location—the synthetic organic chemical industry may be started in chief port towns like Bombay, Calcutta, and Madras, and also in big scientific research centres like Bangalore.

PHARMACEUTICAL PREPARATIONS

16. We recommend that large factories for the manufacture of alcoholic and pharmaceutical preparations be set up at all big consuming centres, in order to minimise the difficulties of transport.

17. The Universities in India should be required to give training in Pharmaceutical Chemistry and institute a degree in the subject.

18. The quality of crude drugs, both imported and grown in the country, should be strictly controlled.

19. The import duty on manufactured drugs should be increased by 5 per cent.

20. The import duty on crude drugs not available in India should be abolished or appreciably reduced.

21. The imposition of export duty on raw materials obtainable only in India should be considered.

22. Arrangements may be made for the supply of solvents needed for the industry, duty free, or the duties should be considerably reduced.

23. The restrictions upon the free transit of spirituous preparations between the diferent provinces in India should be removed.

24. The excise regulations should be suitably modified.

25. The drug industry should be encouraged by the Government by the purchase of materials from Indian manufacturers.

26. The proposed Drugs Act of 1940 should be suitably modified, with special reference to the following:

The proposed Drugs Technical Advisory Board should have better representation of chemists and pharmacists.

EXPLOSIVES

27. In order to get over the difficulty of suitable staff for running an Industrial Explosives Factory, it is suggested that, in the beginning, at least half of this may be obtained from a leading explosive manufacturing English Company, which supplies mainly the present demand of India.

28. A central factory for industrial explosives must be situated in a cool place near a flowing river and railway, but at least three miles away from big towns. In order to reduce railway freight the factory should be located near the coal fields of Bengal or Central Provinces.

29. Fireworks factories may be started in different parts of India where there is a large demand near big cities. This industry will thrive better if the present Government restrictions on the storage and transport of sparklers be removed or modified, so as to bring them in line with those operating for safety matches, where the risk of fire and explosion is actually greater.

30. It should be possible to manufacture most of the chemicals for military explosives in this country.

31. It is necessary to organise the fermentation industry so that in addition to alcohol other solvents like fusel oil and glycerol can also be produced from this industry.

32. The National Planning Committee should seriously take up the problem of establishing Petroleum Refineries in India.

PLASTICS

33. We suggest that the Lac Research Institute at Ranchi, which is doing work of great importance on the manufacture of plastics from lac, should be expanded and converted into a central Institute for research work connected with the industry of the manufacture of plastics in general.

GENERAL

34. In cases where skilled technical labour is not available, experts may be brought over from abroad on short term contracts on the definite understanding that they shall fully train up Indians during their term of service. In other cases, young Indians who have received the best available training here, may be sent abroad for training for the particular industries.

35. The Chemical Industry being a Key Industry, must be fostered at all costs. Various Branches of this Industry must be given adequate state protection in one or more of the following ways, as required:

(i) Prohibition of imports. Imports of finished products should be prohibited for a certain number of years except in special cases, where they may be imported under license from the Government. This would apply to substances like dyes and drugs.

(ii) Protective import duty for a definite period, e.g. in the case of heavy chemicals.

(ii) Free import of raw materials and chemicals, which are not available in the country, e.g. in the case of compounds of Arsenic, Lead, Sulphur, Tin, etc.

As stated by themselves, the Sub-Committee had had to work under considerable handicaps, of lack of data from official or authoritative sources or the relevant information from those directly engaged in the industry. They have also not been able to consult with such of the other Sub-Committees,—e.g., Manufacturing Industries, or the Power and Fuel Sub-Committees—whose work was interconnected or mutually concerned. This was due to no fault on their side; but solely for want of time, and because the other Sub-Committees concerned had not been able to arrange for mutual consultation.

Despite these handicaps, the Report makes several constructive proposals, which are not, essentially speaking, out of date because of the lapse of time since the Report was first presented. The National Planning Committee have taken their decisions on this Report, which are reproduced in this volume, to indicate the trend of opinion in that body on the subject.

Much has, no doubt, happened in recent years in regard to this great industry in its several aspects, which may vitally affect the line of action that may be adopted when a National Plan is being finally given effect to. Many new Chemical inventions have been made; a whole new industry of Plastics has been brought into existence; old materials have been turned to new uses, during and because of the War, which must be taken into account before a proper National Plan can be formulated and carried into effect in this behalf. Several of these developments have been summarised at the end of the Volume in summary form, and based on the reports of some of the Panels appointed by Government during the War, which will provide their own interest to the future planner for all India.

There is, however, an item of the Sub-Committee's reference, which deserves more than a passing mention. The possibilities of developing an Export trade in chemicals made in India cannot be exaggerated, though, for some years to come, while the Industry is being built up, India may herself remain a considerable importer of Chemicals and Drugs. The countries of Asia, who met in conference for the first time at New Delhi last March (1947), have revealed possibilities and directions of co-operation, to mutual benefit, which are hardly yet appreciated or envisaged by those in command of the destinies of these millions upon millions. Some of these countries are much less developed than ours, industrially speaking; and they would offer an immense market for Indian exports, if only India learns the lesson left by European Imperialism, and does not seek to build up her industries solely, or even predominantly, with a view to export, to dump her wares on other countries. The right to national self-sufficiency of each country must be respected; but trade in its natural channels may still be possible.

INTERIM REPORT OF THE CHEMICALS SUB-COMMITTEE

Terms of Reference

1. The Chemicals Sub-Committee was constituted by the National Planning Committee with the following terms of reference:—

(1) To make a census of chemicals and fertilisers produced in India and imported from abroad.
(2) To survey the potentialities for the manufacture of chemicals in India.
(3) To form an estimate of the country's requirements in chemicals on a progressive scale for the next ten years.
(4) To recommend ways and means for developing chemical industries in order to supply the Nation's requirements for the next ten years.
(5) To recommend such legislation or special concessions as may be necessary for the encouragement and development of these industries.
(6) To review the possibility of export trade in chemicals for the manufacture of which India possesses special advantages.

2. Interim Report

The first meeting of the Sub-Committee was held on the 8th September and the second meeting on the 1st October 1939, in which the plan of work was settled and each member of the committee was assigned, either individually or in groups, the task of preparing a report on the subjects in which he is specially interested. Reports have not yet been received from all the members of the Sub-Committee; but in view of the urgent need to expedite the work of the National Planning Committee, we beg to submit this Interim Report, which embodies only our tentative conclusions.

3. Lack of Reliable Information regarding Indigenous production of chemicals and drugs

It is necessary at the outset to make the distressing observation, that with a few laudable exceptions, our requests for

information regarding the amount and value of chemicals produced in India have not been given due consideration by the manufacturers. There is a feeling that such information which may be of considerable value to rivals, may leak out, and in the interest of the manufacturing firm should be withheld from the Sub-Committee. National Planning is obviously impossible if this attitude were to prevail. It is well known that manufacturing concerns in India, when they urge their case for protection before the Tariff Board, are required to submit the fullest information to the Board regarding raw materials, manufacturing processes, cost of production, the quality and value of finished goods. In a system of planned economy, every industry will receive some kind of protection or other, and we therefore recommend that

manufacturing concerns in India should be permitted to carry on their work only under a licence from the State, which should inter-alia provide for the compulsory supply of such information as is demanded by the State with such safeguards as are considered necessary and equitable.

4. Lack of details in the statistics regarding the sea-borne trade of India

For the reasons stated above, we had to rely often on private information regarding the production of chemicals and drugs in India. We do not therefore claim that statistics relating to these figures, wherever they occur in this report, are very accurate. For collection of information regarding the import of chemicals from abroad we have relied on the "Statistics of the Sea-borne Trade of India." **This compilation is very useful, but its usefulness could still further be increased, especially for such surveys in future, if every individual item of import relating to drugs and chemicals, whose value exceeds Rs. 50,000/- a year were included in the Tables.** For example, it should be possible to find out immediately from these Tables, the import in value and quantity of a commodity like aspirin, instead of having to rely for such information on the results of enquiry made in the markets of Bombay and Calcutta. It may be noted that while imports of a heavy chemical like soda-ash has increased from 790,000 cwts. in 1923-24 to 1487,000 cwts. in 1937-38; that of magnesium chloride has diminished during this period from 76,000 cwts. to 12,000 cwts., indicating that the country is rapidly becoming self-sufficient regarding the production of magnesium compounds. This kind of indirect evidence has also been used to check the figures of internal production. It is convenient for the purpose of this report to classify the chemicals into groups and devote a section of the report to the major problem of each group.

SECTION I

HEAVY CHEMICALS

5. A bird's eye view of the present position of this industry is given in Table I.

Chemicals	Import in tons	Year	Price Rs.	Manufacture in India in tons	Year	Remarks
Sulphuric acid	290	1937		28,000	1937	
Nitric acid	300	1937		1,200	1937	70 p.c. strength
Hydrochloric acid	80	1937		1,000	1936	33 p.c. strength
Sulphur	46,500	1937		nil		
Soda Ash	40,000	1923-24	51,60,000	nil		
,,	70,000	1937-38	59,60,000	nil		
Bicarbonate of soda	5,200	1923-24	9,70,000	nil		
—Do—	6,200	1937-38	5,60,000	nil		
Caustic soda	5,100	1923-24	16,90,000	nil		
,,	26,000	1937-38	42,80,000	nil		
Sodium Silicate	1,600	1937-38	1,80,000	1,700	1937	
Sodium Sulphate	2,530	1937		1,200	1936	
Sodium Sulphide	4,100	1937		nil		
Sodium Nitrate	2,100	1938-39	2,20,000	nil		
Potassium Chloride	220	1926-27	5,30,000	nil		
,,	150	1937-38	2,80,000	nil		
Potassium Nitrate	nil			7,000	1937	
Potassium Dichromate	1,500	1937		nil		
Sodium Dichromate	420	1937		nil		
Potassium Chlorate	2,500	1935-36		nil		
Ammonium Chloride	2,500	1935-36		nil		
Anhydrous Ammonia	420	1937		nil		
Calcium carbide	4,300	1937		nil		
Bleaching powder	3,100	1923-24	7,00,000	nil		
,,	12,000	1937-38	13,10,000	2,800	1937	
Liquid Chlorine	350	1937				
Magnesium chloride	3,800	1923-24	2,30,000	5,500	1936	
,,	600	1937-38	40,000			
Magnesium sulphate	1,900	1923-24	1,20,000	3,000	1936	
,,	420	1937-38	52,000	nil		
Aluminium sulphate, Alum, Ferric Alum	2,100	1937-38		10,000	1936	
Ferrous sulphate	100	1935-36		500	1936	
Copper sulphate	2,800	1937		negligible		
Zinc chloride	1,400	1927-28	4,10,000			
,,	860	1928-29	2,30,000			
,,	1,700	1937-38	3,60,000			
Borax	2,700	1937-38				

TABLE (a) FERTILIZERS

Ammonium Sulphate	37,600	1932-33			
,,	76,700	1938-39	83,00,000	18,000	1936
Phosphatic fertilisers:					
Super phosphate	6,800	1938-39	5,68,000	nil	
Other phosphates	3,900	1938-39	4,00,000	nil	
Ammonium phosphate	2,600	1938-39	3,95,000	nil	

6. SULPHUR & SULPHURIC ACID.

Sulphuric acid is one of the most important key chemicals in the industrial world. The present production of 28,000 tons should have to be increased to 90,000 tons a year if the country is to become self-sufficient as regards the manufacture of Sulphates and fertilizers on the present basis of requirements. Even if the present industrial progress is maintained, for self-sufficiency at the end of ten years, the production should rise to 200,000 tons. Since sulphuric acid is a basic chemical whose cost of production enters into the cost of production of a large number of finished products, attempts should be made to manufacture it as cheaply as possible. Unfortunately in India, we have no large deposit of sulphur. The known deposits of pyrites are often small pockets or are located in inaccessible areas. Sulphur at Rs. 100 a ton would yield sulphuric at Rs. 50 a ton; and if, as at the present time, the price of sulphur rises to the neighbourhood of Rs. 200 per ton, sulphuric acid can be produced at Rs. 85 a ton. This is too high a price and attempts must be made to find alternative sources of sulphur. The technical skill for the manufacture of sulphuric acid by the lead chamber process has long been available in the country; and in recent years the newer method of manufacturing this acid by the contact process has been adopted with success. For example, in the plant of the Mysore Chemicals and Fertilisers Co., about 25 tons of Sulphuric acid can be made every day by the aid of Vanadium Catalysts. Deposits of pyrites have recently been reported from the districts of Simla, Shahabad in Bihar and from Ratnagiri in Bombay. We recommend strongly that a detailed survey of pyrite deposits be made in India at an early date. Failing discovery of suitable deposits of sulphur or pyrites, we recommend that the economic possibility of recovering sulphur or manufacturing sulphuric acid from the following sources be carefully examined:—

(a) Sulphur from Chalcopyrites:

In Singbhum District, the chalcopyrites are being worked by the Indian Copper Corporation for the extraction of copper. It is stated that about 20 tons of sulphur are escaping into the atmosphere every day, during the process of roasting the ore. There are big plants in Canada, Finland and other countries for converting such sulphur-dioxide into sulphur. There is no reason

why similar attempts should not be made at the works of the Indian Copper Corporation.

(b) **Sulphur from Gypsum.**

Gypsum occurs in large quantities in Sind, Rajputana, the Punjab, in the Himalayan Hills, in U.P. and in Madras. In Germany, gypsum has been utilised for the manufacture of cement in place of limestone, the sulphur dioxide evolved being reduced to sulphur or converted into sulphuric acid. Dr. Dubey estimates that a 500 ton cement plant at Dundol near the salt range, can utilise the gypsum deposits in the neighbourhood and produce 80 tons of sulphur every day which can be marketed at Rs. 40|- per ton. Sulphur, even at Rs. 50|- a ton will yield sulphuric acid at Rs. 33|- a ton, and will remove the major handicap of India in the development of the heavy chemical industries. We recommend very strongly that this scheme be carefully examined by experts in cement manufacture.

(c) **Sulphur from Assam Coal.**

Extensive deposits of teritary coals have been found in Assam. They contain on an average 4% sulphur. Experiments should be started immediately to recover sulphur from the coals.

7. AMMONIA, NITRIC ACID, POTASSIUM NITRATE, SODIUM NITRATE.

(a) Nitric acid is produced in India at the present time by the action of sulphuric acid on potassium nitrate. The available sources of potassium nitrate are such that the peace time requirements of nitric acid can be met from this source. Chemical industries are, however, so designed now, that synthetic ammonia which is necesary for fixed-nitrogen fertilisers, can be easily converted to nitric acid for the purposes of war.

Synthetic ammonia. In Mysore, a synthetic ammonia plant has been in operation for some time, which can yield 3,000 tons of anhydrous ammonia. Supposing that it were possible to raise the production of ammonium sulphate by distillation of coal from 18,000 tons to 50,000 tons in the near future, there will still be a gap in the production of ammonium sulphate to the extent of 45,000 tons, which must be secured from the synthetic ammonia industry. We recommend, therefore, that synthetic ammonia plants which will yield at least 15,000 tons of anhydrous ammonia, be put up in the neighbourhood of the coal fields where cheap power and cheap coal are available. Mr. N. G. Chatterjee in **Science and Culture** (Vol. IV, No. 3, Sept. 1938) has given an account of the estimates of a synthetic ammonia plant. Mr. S. G. Shastry, the Managing Director of the Mysore Chemicals, from his personal experience, states that it will not

be difficult to prepare plans and estimates, if it is definitely settled that a factory with a predetermined output is to be started in any given locality.

(b) Conversion of Ammonia into Nitric acid, Urea and Ammonium phosphate.

In view of the difficulties in the way of cheap production of sulphuric acid in India, we recommend that, instead of fixing ammonia as ammonium sulphate for use as a fertiliser, ammonia should largely be converted into nitro-chalk, urea, and ammonium phosphate as fertilisers. In many parts of the world, these fertilisers are considered at least as valuable as ammonium sulphate. In India, however, the value of these fertilisers has not yet been tested by field experiments. We recommend strongly that field experiments on a statistical basis be immediately started in representative localities of India with a view to ascertain the value of these fertilisers relating to the growth of sugarcane. It need hardly be pointed out that conversion of ammonia into urea not only yields a valuable fertiliser but also a material which is the starting point for the manufacture of synthetic plastics.

8. HYDROCHLORIC ACID, AMMONIUM CHLORIDE, ZINC CHLORIDE, SODIUM SULPHATE, SODIUM SULPHIDE.

The manufacture of hydrochloric acid, ammonium chloride, zinc chloride, sodium sulphate and sodium sulphide are linked together. Sodium sulphate is needed in the paper industry and sodium sulphide is used in the dyeing and tanning industries. Replacement of the import of these chemicals by manufacture in India from sodium chloride and sulphuric acid will yield about 5,000 tons of anhydrous hydrochloric acid as by-product. This hydrochloric acid will be more than sufficient to produce from zinc and from ammonia respectively our present requirements of zinc chloride and ammonium chloride. In this connection, we would draw the attention of the N.P.C. to the following extract from a bulletin by Mr. N. Sengupta (No. 8. Industrial Research Bureau): "The Tatanagar Chemicals Co., Ltd. commenced the manufacture of 85% Zn Cl2 in 1932. The raw materials were the galvanisers' pot skimmings.....The venture was short-lived owing to the fact that an imported grade of 98% purity was offered to the market at the same price as the 85% grade. The manufacturing difficulties involved in raising the purity of the material proved too great for the Company. It is doubtful whether an economical production of Zinc Chloride will be possible in this country, until the conditions become such as substantially to lower the cost of production of sulphuric acid".

We have not yet had an opportunity of discussing with the Manufacturing Industries Sub-Committee their plans for the

accelerated progress of the paper, dyeing and the tanning industries. We are, therefore, not in a position to form an estimate of the country's requirements of sodium sulphate and sodium sulphide at the end of ten years; this however is a minor problem whose solution will depend on the production of cheap sulphuric acid.

9. SODA ASH AND CAUSTIC SODA.

The value of soda ash, sodium bicarbonate and caustic soda imported into India in 1937-38 exceeded a crore of rupees. This is a key industry which should be fostered in India at all costs. It is, therefore, a matter of great satisfaction, that the Tata Chemicals Ltd. are erecting a plant for the manufacture of these alkalies at Okha where cheap salt and limestone are available. The Imperial Chemical Industries (India) Ltd. are also opening a factory in the neighbourhood of Calcutta for the manufacture of the same compounds. The capital at the disposal of these two great concerns are such that it may be hoped that the initial difficulties will soon be overcome and that India could be assured a regular cheap supply of alkalis from factories within her own borders.

10. MAGNESIUM SALTS.

Magnesium sulphate and magnesium chloride are largely required in the Textile Industries. The import of these chemicals into India is steadily decreasing. The Pioneer Magnesia Works at Kharaghoda and Mithapur are mainly responsible for the production of magnesium chloride. The sulphate is produced from magnesite, obtained mainly from Salem in Madras, and also from the Mysore State. The industry is practically standing on its own legs, and only a little effort is necessary to make the country self-sufficient as regards these commodities.

11. ALUMINIUM SULPHATE, ALUM, ALUMINE-FERRIC.

The grade of aluminium sulphate, alum and alumine-ferric which are now manufactured by Indian concerns is quite suitable for purification of water. The indigenous product is also used in the manufacture of paper; but for use in the dyeing process aluminium sulphate should be absolutely free from iron. So far as is known, the purest variety of aluminium sulphate has not yet been manufactured in this country, and this is largely the variety which is even now imported. Projects are on the way to completion for the erection of plants for the manufacture of aluminium at Asansol, and in Bombay territory adjoining the Jog Falls. If these schemes materialise, aluminium hydroxide absolutely free from iron will have to be produced as intermediate products in these factories. With a cheap supply of

pure aluminium hydroxide, the manufacture of pure aluminium sulphate does not present much difficulty.

12. FERROUS SULPHATE, COPPER SULPHATE.

The country is practically self-sufficient as regards ferrous sulphate which is mainly used in the ink-industry. But our imports of copper sulphate which is mainly used as fungicide are rapidly increasing. Its manufacture in India has been retarded by the high cost of scrap copper which is the chief raw material. There is no reason why the trade in scrap copper should not be properly organised in the country at an early date.

13. ELECTRO-CHEMICAL AND ELCTRO-THERMAL INDUSTRIES.

Caustic soda, chlorine, bleaching powder, potassium chlorate and sodium cyanide, calcium-carbide and graphite are the chief chemicals which are produced by electro-chemical and electro-thermal processes. A small quantity of chlorine, bleaching powder and caustic soda is manufactured even now in Titagarh Paper Mills, Bengal Chemical & Pharmaceutical Works, and in Mysore Paper Mills. Many cotton mills in India have also put up small plants for the production of chlorine to meet their requirements of bleaching materials. A plant for the electrolytic production of caustic soda and bleaching powder was erected at Mettur about a year ago, with concessions from the Government of Madras regarding the supply of electricity and water. But for reasons not sufficiently known, this factory, which could have made handsome profits by taking advantage of the present war conditions, has not yet begun work. It is strange that sodium cyanide, more than Rs. 2|- lakhs in value, should be imported into the Kolar Gold Fields, while the Mysore Government is prepared to sell electrical power at 1|8th of an anna per unit. We have not had the advantage of consulting the Power-Sub-Committee regarding the plans for the development of electrical power in India. If proper technical skill and cheap electrical power are available, there should be no difficulty in producing these commodities in the country itself according to our requirements.

14. BICHROMATES.

Sodium and potassium bichromates are largely used in the dyeing and tanning processes, and at the present moment, there is a famine in the Indian market with regard to these commodities. In the State of Mysore, there are very good deposits of chrome ore and a large export trade in this ore has been built up. This ore also occurs in other parts of India, e.g., Chotanagpur, Baluchistan etc. During the last Great War, factories for

the manufacture of dichromate were set up, but they went into liquidation shortly after the end of the war. For successful manufacture of dichromate, besides the ore of good quality, it is necessary to have a cheap supply of sulphuric acid, soda, and fuel. It is probable that an experimental plant will soon be set up in the Mysore State for the manufacture of dichromate. We recommend that an expert committee be appointed to select a site for the location of the factory with due regard to the facilities for transport and availablitiy of the ore, sulphuric acid, soda and fuel at the cheapest rate. There are reasons to hope that if these facilities are available, an export trade in dichromate can be built up in place of the crude chrome ore.

15. BORAX.

Practically, the entire requirement of the country in Borax is imported. It is well known that the hot springs of Kashmir and Tibet contain boric acid. We recommend that the hot springs of all the volcanic regions in India should be examined with a view to finding out their boric acid content, preliminary to any attempt to produce boric acid in the country.

16. FERTILISERS : POTASSIUM COMPOUNDS

We have dealt with the problem of fixed nitrogen fertilisers in paragraph 7. The other two principal ingredients of plant food are potassium and phosphorus. Potassium nitrate is even now manufactured in large quantities in India from soil efflorescence in Bihar and other parts. It has been estimated by reliable observers, that more than 100,000 tons each of magnesium sulphate and magnesium chloride, and 15,000 tons of potassium bromide are annually wasted in the Indian bitterns. We, therefore, recommend that investigations should be started on Indian bitterns, with a view to the economic recovery of potassium and bromine, both of which are valuable chemicals. If such an enquiry yields promising results, a site for the erection of a factory for the manufacture of potassium salts and bromine, may be selected in a suitable area.

17. PHOSPHATIC COMPOUNDS

The raw materials for manufacturing the Inorganic phosphatic manures, which are used in large quantities in India, have not yet been thoroughly surveyed. Attempts to prepare super-phosphate from bones are not likely to succeed, and such bones as are available may better be used as bone-meal. There are deposits of apatites in Singhbhum and other parts of India, but the possibility of their economic exploitation has not yet been thoroughly investigated. There are fairly extensive deposits of phosphatic nodules in Trichinopoly District. Preliminary investigation of some samples in the Indian Institute of Science

appears very promising, as the samples have been found to contain 61 per cent calcium phosphate and only 5 per cent calcium fluoride. We recommend very strongly that a thorough survey of these deposits be undertaken with a view to finding out their total availability and also ascertaining if representative samples from different localities have similar composition as that given above. If these indigenous supplies are not adequate, the nearest source of high class phosphate rock will be Christmas Island. If we import phosphate rock from abroad, then it will be necessary to start manufacture of superphosphate and triple super at a port town favourably situated in respect of import of raw materials, and nearness to consuming centres. We also recommend that the question of manufacture of ammonium phosphate should be fully investigated, when problems relating to the manufacture of synthetic ammonia and phosphoric acid have been successfully tackled.

SECTION II

DISTILLATION OF COAL AND COAL TAR PRODUCTS

18. COAL TAR THE BASIS OF THE DYE AND DRUG INDUSTRY

The manufacture of dyes, drugs, and other synthetic organic chemicals, which are imported annually to the value of over four crores of rupees, is non-existent in the country; and it is to the establishment of this industry that urgent attention must be paid. The national importance of this industry as a key industry cannot be over-emphasised, as it is an industry of vital importance for the well-being of the nation, both in times of peace and war, as the manufacture of explosives and other war-chemicals is also directly connected with this industry. The basic material for this industry is coal tar, only a small fraction of which is at present distilled crudely, for obtaining creosote oil used for manufacture of disinfectants, naphthalene, and pitch used for tarring roads.

19. COAL TAR DISTILLATION

Coal tar as a bye-product of the coking industry is produced in large quantities in India. Coal is mainly carbonised by the high temperature carbonisation process for obtaining metallurgical coke needed in iron and steel works, and to a much smaller extent for producing coal gas in large cities. The bulk of the coal tar at present is obtained from the coke oven plants in the Bengal coal fields, and the surrounding iron and steel works. During the year 1938-39, the production of coal tar, which is obtained in a yield of about 2-3 per cent on the weight of the coal, amounted to about 58,000 tons. The Tata Iron and Steel Works produced over 50 per cent of the tonnage given above. The imports of coal tar and pitch during the year was negligible, viz., 2,800 tons.

The distillation of coal tar to obtain the important coal tar products benzene, toluene, etc., which are the starting materials for the manufacture of dyes and drugs, etc., has so far not been attempted in India on a large scale, although a beginning is just being made at Jamshedpur with the view to supplying toluene to the Government for explosives. Installations for coal

tar distillation have also been recently made by the Shalimar Tar Products, Ltd., The Beraree Coke Co. Ltd., and Messrs. Bengal Iron Company.

20. ESTIMATED QUANTITIES

Although the recovery of the bye-products of coal distillation is not likely to be profitable under the present circumstances, this industry, as a key industry must be started on as wide a scale as possible, with the required State help and protection in a suitable form. At the present rate, at which the industry of coal tar production progresses, it may be assumed that over the period of the next ten years, approximately 55,000 tons of tar would be available for distillation per year. This quantity on distillation would approximately give the following quantities of the principal finished raw products for dye and drug manufacture :

Product:		Tons/year.
Benzene and toluene	....	390
Other light oils	....	145
Phenol	....	165
Cresols	....	165
Naphthalene	....	2,400
Creosote	....	16,000
Anthracene	....	165
Pitch	....	31,500

The approximate quantities of the above products required for the manufacture of dyes are shown in the Appendix No. 1 to the Section on "Dyes and Textile Auxiliary Agents." Dependable figures of the quantities of some of the above, required for the manufacture of drugs, are not available and, therefore, no definite statement is possible regarding the total requirements of the above products. It can be safely presumed, however, that the above quantities would substantially meet the demand except in the case of benzene. Additional quantity of benzene would be available, if the benzene is also recovered from the gaseous products of coal distillation by a benzol-recovering plant. At present 23 million tons of coal are being produced annually in the country, of which 2 million tons are distilled, which yield the coal tar and 20,000 tons of ammonium sulphate. We recommend that 3 million tons of coal should be annually converted, in addition, into soft coke for domestic consumption, by the low temperature carbonisation process. This will do away with the production of smoke, leading to more healthy conditions, and further yield additional quantities of ammonium sulphate and coal-tar, which would be available for distillation. The combined bye-products of ammonium sulphate and coal tar from the

5 million tons of coal carbonised, would, it may be presumed, fully meet the country's requirements of ammonium sulphate and coal tar products.

21. ESTIMATES

The approximate capital outlay required for a coal tar distillation plant, having a capacity of 100 tons a day, would be about 7 lakhs of rupees, while for one with a capacity of 200 tons a day the capital outlay required would be about ten lakhs. The production cost may be roughly estimated at Rs. 5-10 per ton of tar. In addition a Benzol Recovery Plant for the recovery of benzene from the gaseous product of coal carbonisation would be required. The approximate cost of such a plant for the recovery of about 1½ million tons of benzene per year would be Rs. 20 lakhs, and the cost of the benzene refining plant would be about Rs. 8 lakhs. A further outlay of Rs. 2 lakhs would be required for a plant producing 200 tons of naphthalene per year, the production cost being about Rs. 70 per ton of naphthalene.

22. LOCATION

The plants for the carbonisation of coal and for coal tar distillation should be located near the coal fields of Bengal. The separated products of coal tar distillation may then be transferred to a separate factory near by for the manufacture of intermediate products for dyes and drugs. The finished intermediates may then be transported to separate factories for the manufacture of dyes and drugs and other related synthetic organic chemicals, which may be located near big consuming and trade centres like Bombay and Calcutta.

In connection with the carbonisation of coal, attention may finally be drawn to the interesting suggestions of Dr. H. K. Sen (Presidential Address to the Indian Chemical Manufacturers' Association, 1939) that high temperature carbonisation of coal may be profitably supplemented by the low temperature carbonisation process. It may be pointed out, however, that this is a matter, which would require further extensive experimental investigation.

SECTION III

DYES AND TEXTILE AUXILIARY AGENTS

23. STATISTICAL DATA OF CONSUMPTION

As the answers to the enquiries regarding the quantities of various dyes and textile auxiliary agents consumed in India, sent out to various mills and consumers, have been very meagre, the approximate figures arrived at have been arrived at by rough calculations from the scanty answers received, and from private bazar enquiries. The quantities of the different dyes and textile auxiliary agents consumed in India are given in Appendix No. II. Appendix No. III gives the figures for the imports of dyes and textile auxiliary agents during the year 1937-1938, the total value being 4 crores of Rupees.

24. ESTIMATES

Since the production of hundreds of dyes, regarding the chemical nature of many of which no precise information is available, would be utterly impossible in the limits of a 10 year plan, the estimates of requirements have taken into account only the most important dyes in each class. The total number of dyes have thus been reduced to 17 in the case of Direct colours, 10 in Basic colours, 12 in Vat colours, 10 in Naphthols, 8 in Bases, and 11 in Miscellaneous.

Appendix IV gives the estimated yearly requirements for a 10 year plan, together with other relevant information, like the intermediates required and their quantities. Appendix V gives figures for the imports of dyes into India during the years 1935-36, 1936-37, 1937-38. It also contains the figures separately for some of the parts of India. Appendix VI contains the total yearly requirements of the various intermediates, and Appendix VII gives the total requirements of the different raw materials, viz. the coal tar distillation products.

25. A CASE FOR THE INDIAN DYESTUFF INDUSTRY

The history of the British Dyestuff industry is an object lesson to us in our present position. Before the last war, Great Britain did not possess a dystuff industry of any importance,

over 90 per cent of the dyes used being imported from Germany. As the last Great War progressed, the situation became very serious, and it was realised that the British dependence on Germany for dyes was really tantamount to a much wider and more fundamental weakness of British Chemical industry, as the production of dyes was intimately connected with the production of chemicals, in general. Having realised the vital necessity of the development of a dyestuff industry, the British Government took immediate and far-reaching steps in this direction. Beginning with a direct and large subsidy for the formation of a new company, millions were spent on the rapid development of every branch of the industry, with very special reference to research. Later on, the importation of dyes and even intermediates was prohibitied, except under license for very special reasons. As a result, the British dyestuff factories are now producing over 90 per cent of their home requirements and have in addition a considerable export trade.

With textiles as our primary industry, and the incidence of a host of diseases responsible for the consumption of an immense quantity of medicinal chemicals, the immediate establishment of a coal tar dyestuff industry is a matter of such urgent necessity that the fullest resources of the State and the individual must be mobilised for the purpose. In the earlier stages, it may be suggested, the intermediates may even be bought from foreign markets till a coal tar industry is established in the country.

26. TEXTILE AUXILIARY AGENTS

It has been very difficult to get any reliable data on this subject, and the only recommendation that can be made at this stage is that we should concentrate on the production of the sulphonated oils and of the Gardinol and Lissapol types of wetting agents. Both the classes require vegetable oils as starting material. Among the proprietary wetting agents used, the two outstanding are Igaphan T and Nekal Bx. Although Igaphan T is covered by patents, it should be possible to evolve equally good other substances of a similar nature. The factories for the production of textile auxiliary agents would best be situated in the immediate neighbourhood of cotton mills since vegetable oils and sulphuric acid are both available within a reasonable distance.

SECTION IV

(A) FINE CHEMICALS

FINE CHEMICALS, SYNTHETIC DRUGS, BIOLOGICALS, SYNTHETIC PERFUMES AND ESSENTIAL OILS

27. **Statistical Data.** Fine chemicals, and Synthetic drugs, synthetic perfumes, production of synthetic organic chemicals, including synthetic drugs and synthetic perfumes, in India, is practically nil. Some costly organic chemicals numbering 300 have been prepared on the laboratory scale in the Preparation Section of the Indian Institute of Science, chiefly for their own research purposes. The import figures for drugs as available in the sea borne trade returns for the last 5 years are as follows:—

1934-1935	....	Rs. 1,91,90,000
1935-1936	....	,, 2,11,17,000
1937-1938	....	,, 2,06,83,000
1938-1939	....	,, 2,36,17,000
1939-1940	....	,, 2,20,53,000

These figures would also include other drugs, besides synthetic. Efforts were made to collect the relevant data from Indian Dealers, Custom Officers, Pharmaceutical Works and some Indian Laboratories, but no reliable figures are available. Appendix VIII shows the names of the principal drugs, with the quantities annually consumed in India and their value, which have been estimately arrived at by appropriate calculation from the little information that has been available.

Raw Materials. It is well known that the raw materials for the production of these synthetic preparations are chiefly derived from coal tar, petroleum, wood distillation and fermentation industries; in some cases other vegetable products and some animal products supply the raw materials. The importance of coal tar as the basis of the drug industry has already been emphasised. Useful products can be obtained from petroleum, besides petroleum used as solvent and for fuel. Attention has been drawn elsewhere to the necessity of establishing petroleum refineries in India, as in other countries, so that these other useful products may be recovered. The chief products of wood distillation are acetic acid and acetone and methyl

alcohol, which can serve as starting points of other chemicals. Solvents like alcohol, fusel oil, glycerol, and various glycols are the products of the fermentation industries which can be prepared. At present ethyl alcohol is practically the only product obtained by fermentation processes. The various fatty oils abundantly available in the country would also be the starting points for the manufacture of stearic and palmitic acids, etc. and substances derived from them.

Plant. Unlike the heavy chemical industry, the fine chemical industry is not one where a plant can be put up and the products turned out on tonnage basis. In this case, small separate units will have to be set up, probably for every different type of chemicals. Although, due to war conditions, it may not be possible to get these plants and machineries from abroad, it appears feasible to build up such small plants in many cases, with the help of materials and workmanship available in India. In the case of highly specialised and costly synthetic chemicals and drugs, which have to be prepared in small quantities, glass, utensils and apparatus can even be conveniently and profitably used.

The principal processes involved in this subject of synthetic organic chemicals' manufacture consist of the following:—

1. Nitration.
2. Amination.
3. Sulphonation.
4. Oxidation.
5. Reduction.
6. Alkylation.
7. Acylation.
8. Halogenation.
9. Diazotisation.
10. Coupling.
11. Esterification.
12. Saponification or Hydrolysis.
13. Decarboxylation.
14. Electrolytic Operations.
15. Catalytic Processes.
16. Different kinds of Condensation.
17. Unsaturation.
18. Addition of different reagents on 17.
19. Ring Closure.
20. Ring Opening etc. etc.

Skilled Labour. Skilled labour in the form of well trained chemists, even with considerable research experience, is abundantly available in the country.

Location. The synthetic organic chemical industry may be started in chief port towns like Bombay, Calcutta, and Madras and also in big scientific research centres like Bangalore.

Appendix IX contains a list of the principal synthetic drugs about which the relevant information regarding raw materials, economics of production, etc., has been collected.

(B) BIOLOGICALS

The following products have been dealt with:

1. Vitamin B 1 — Concentrate.
2. Vitamin B 2 — Concentrate.
3. Vitamin C.
4. Vitamin D.
5. Lecithin
6. Adrenalin.
7. Insulin.
8. Pituitary extracts.
9. Liver Extracts.
10. Thyroid.
11. Papain.
12. Pepsin.
13. Oestrone.
14. Progesterone.
15. Synthetic Vitamin B 1.
16. Synthetic Vitamin B 2.
17. Fish liver oils (Vitamin A and D).

A sheet has been devoted to each product, indicating, as far as possible, (a) the method of preparation, (b) the units of operation, (c) the materials required for the production of unit quantity of the final product, (d) the present prices of the materials, (e) the sources from which these materials are obtainable, (f) the cost of industrial production of the finished product, (g) the present price of the finished product, (h) reference to the method of preparation. Unfortunately, complete or accurate information under all these heads is not obtainable.

Plant and Machinery. From the standpoint of industry, most of these products, though essential, are not required in very large quantities. The units of operation should indicate which of the larger pieces of apparatus would be required in the production. The cost sheet can only be worked out in relation to the production of other drugs in the same factory and in relation to the cost of the reagents, most of which are obtainable only from heavy industries. The machinery and apparatus required for one of these products can obviously be used for numerous similar products included in the series of drugs and fine chemicals.

Since it is not immediately known how many drugs and fine chemicals and how much of these will be produced in one factory, the following general basis for calculation of the cost of industrial production has been adopted, starting from the cost of materials as the base line. The other costs involved have been calculated as percentages of the cost of materials. This is somewhat arbitrary but seems to correspond roughly to the experience in drug industries in India.

(a) cost of materials.
(b) Depreciation of machinery and interest on blocked capital—15% of (a)
(c) Power—5% of (a)
(d) Containers and packing—15% of (a)
(e) Labour (scientific and ordinary)—20% of (a)
(f) Overhead—10% of (a)

(g) Literature, etc.—5% of (a)
(h) Sundries and wastage—10% of (a)

In general, therefore, in calculating the cost of industrial production, 80 per cent of the cost of materials has been added to the cost of materials. This excludes freight, propaganda, commission, etc. In planned production and distribution, however, the cost on propaganda and commission, etc. should be small. It should be noted that this costing is only provisional, as it is of a general character and should be revised in future on the basis of more complete and more accurate information, both in relation to each product, and in relation to the number and quantities of products that a particular factory is expected to produce. This factory, considering the nature of the products, should be in liaison with certain heavy chemical industries. The cost of materials and reagents given will also, obviously, be altered in a system of planned production, and, therefore, the cost of production of the finished product will also be correspondingly altered.

Enquiries in Calcutta have not given any exact information regarding the present consumption of these products in India. But it seems that three times the present consumption level can be produced easily, except perhaps with regard to adrenalin and pituitary extracts. This is because they are derived from small glands. Owing to the absence of large-scale slaugther houses, such glands do not seem to be obtainable in sufficient numbers.

Sera and vaccines have not been dealt with, as enquiries show that Indian industries can supply any amount of these that can conceivably be required. Card indices will be furnished later.

(C) ESSENTIAL OILS

Statistics.

(a) As mentioned in the case of synthetic chemicals it is regrettable that in every case we have to mention that no definite statistical data, as far as production in India and importation from abroad are concerned, is available. However, in the following table, the available import and export figures are given:

Import.

	Genuine Turpentine	Turpentine substitute
	Rs.	Rs.
1934-35	1,00,000	48,000
1935-36	70,000	53,000
1936-37	88,000	45,000
1937-38	1,11,000	6,39,000
1938-39	44,000	4,58,000

Export

	1938-39
Essential oil seeds.	
Coriander	8,66,000
Cumin (not black)	5,34,000
Other sorts	1,66,000
Essential oils.	
Sandalwood oil	9,47,000
Lemon grass oil	7,13,000
Palmarosa oil	2,34,000
Other sorts	1,18,000

Raw Materials

(b) Even though full data are not available from the figures given above, it is assured that a major portion of the raw materials for finished essential oils are being exported out of India. That means, the potentialities for organised production of essential oils from Indian raw materials are many indeed.

(c) figures not available.

(d) In the absence of facilities, regarding plants and equipments for large scale distillation of essential oils, it is strongly to be recommended that small units, which can be operated locally in the places where raw materials are available, (viz., in the gardens and fields), should be installed. On the other hand, even if it is desired that large scale plants should be made available, because of the noncorrosive character of most of the essential oils, it should be possible to make even big scale plants in India.

Export Trade.

(f) From the export figures of raw materials and sandalwood and other essential oils, it is clear that there is every possibility of a healthy export trade, for these materials, being established in India.

SECTION V

ALCOHOLIC AND PHARMACEUTICAL PREPARATIONS

For the collection of statistical information, an exhaustive list of about 800 to 1,000 pharmaceutical preparations, printed in the form of a booklet, by the kindness of the Alembic Chemical Works Ltd., Baroda, was sent round to various manufacturers of pharmaceutical preparations. The response was, however, extremely poor. A rough estimate of the present position, regarding alcoholic and pharmaceutical preparations has, therefore, been made, which is based on the catalogues of several firms and on the sea-borne trade returns. On this basis the approximate future needs for the next ten years have been put forward.

Present Position

The major portion, i.e., 7/8th of the alcoholic and pharmaceutical preparations is manufactured, at present, by the Government Medical Stores, the Bengal Chemical and Pharmaceutical Works, the Bengal Immunity Company and the Alembic Chemical Works, Ltd.

The approximate amount of rectified spirit consumed in the country for these preparations is about 100,000 gallons, which is distributed as follows:

	Quantity consumed.
The Government Stores at Bombay	15,000 gallons
„ Madras	20,000 „
Alembic Chemical Works Co. Ltd.	20,000 „
The Bengal Chemical and Pharmaceutical Works	15,000 „
The rest of the firms	20,000 „
	90,000 „

The latest statistics show that drugs and medicines imported into India are worth about Rs. 2,50,00,000. The approximate value of drugs and medicines used in India, at present, is as under :

1. Those imported		Rs. 2,50,00,000
2. Drugs manufactured in India		
(a) Alembic Chem. Works	Rs. 15,00,000	
(b) Bengal Immunity Co.	15,00,000	
(c) Bengal Chem. & Pharm.	15,00,000	
(d) Other firms	30,00,000	75,00,000
3. Drugs manufactured by Government Medical Stores at Bombay and Madras		45,00,000
		Rs. 3,70,00,000

or roughly Rs. 4,00,00,000

Future Needs

India could be expected to consume drugs and medicines worth about Rs. 8,00,00,000 by the end of the next ten years. This estimate, of course, excludes the needs so far supplied by the Ayurvedic and Unani medicines used by the public.

Chief Difficulties

To minimise the difficulties of transport, large factories for the manufacture of alcoholic and pharmaceutical preparations will have to be set up at all big consuming centres. The chief hindrances in the development of the drug industry are:—

1. Unorganised state of raw materials.
2. Question of transport.
3. Lack of Drug Control Legislation.
4. Unsympathetic excise policy of the Government.

Export Trade

Nearly three-fourths of the drugs mentioned in British and other Pharmacopeas grow in India. Because India possesses all types of climates and variegated soils, acclimatization of several drugs would become possible. These natural facilities, together with the organisation of a Central Plant Industry Board, would make India an exporting centre for medicinal plants all over the world.

Recommendations

1. The Universities in India should be required to give training in Pharmaceutical Chemistry and institute a degree in the subject.

2. The quality of crude drugs, both imported and grown in the country, should be strictly controlled.

3. The import duty on manufactured drugs should be increased by 5 per cent.

4. The import duty on crude drugs, not available in India, should be abolished or appreciably reduced.

5. The imposition of export duty on raw materials, obtainable only in India, should be considered.

6. Arrangements may be made for the supply of solvents needed for the industry, duty free, or the duties should be considerably reduced.

7. The restrictions upon the free transit of spirituous preparations between the different provinces in India should be removed.

8. The excise regulations should be suitably modified.

9. The drug industry should be encouraged by the Government, by the purchase of materials from Indian manufacturers.

10. The proposed Drugs Act of 1940 should be suitably modified, with special reference to the following :

The proposed Drugs Technical Advisory Board should have better representation of chemists and pharmacists.

SECTION VI

EXPLOSIVES

Classification. Explosives may be classified as follows, according to the purpose for which they are used in India :—

(a) Military explosives.
(b) Industrial Explosives.
(c) Explosives for sporting purposes.
(d) Fireworks.

(a) Military explosives are used for the manufacture of ammunition required for the Defence and Police Departments of the Government and Ruling Princes. These are either manufactured or imported by the Government of India.

(b) Industrial explosives are used for blasting purposes in various mines and quarries. Powerful modern explosives for such purposes are all imported, mostly from the United Kingdom, mainly under the following trade names :

Blasting gelatine, gelignite, gelatine dynamite, Stonobel, Samsonite.

Blasting gunpowder is manufactured in India near mines and quarries by contractors in sufficient quantities. Blasting fuze and detonators are also imported for firing these blasting charges.

(c) Most of the cartridges required for shot guns and rifles, which are used for hunting, are imported. These are filled with smokeless powder or gunpowder. A small quantity of the latter is manufactured locally for the use of Indian **shikaris** in their muzzle loaders.

(d) It is not exaggerating to say that, in India, there is no celebration worth the name, be it private or public, in which some fireworks are not let off. There is, therefore, a large demand for such explosives. A part of this is met by the output of local cottage industries, scattered all over India and run mainly by Mahomedans. A large quantity is also imported mainly from China, Japan and Germany.

Statistics.

(a) **Military explosives**—no figures are available.

(b) **Industrial explosives**—These include blasting gelatine, gelignite and gelatine dynamite, other nitro-compounds, blasting fuse, blasting coils, detonators, etc. The total value in rupees of industrial explosives imported during the years 1936, 1937, 1938 were approximately 22 lacs, 37 lacs and 26 lacs of rupees respectively.

The average yearly production in India of blasting gunpowder is of the value of about Rs. 2½ lacs.

(c) **Explosives and ammunition for sporting purposes.**

The approximate total value of the yearly import of such explosives is about Rs. 10 lacs.

(d) **Fireworks.**

The value of fireworks imported into India during the year 1938, was about 10 lacs of rupees.

Figures for Indian manufacture cannot be ascertained.

The value of all sorts of explosives manufactured in India may be estimated to be not less than Rs. 5 lacs per year.

Detailed statistics are given in Appendix X.

FUTURE REQUIREMENTS

Industrial Explosives

The development of chemical and metallurgical industries in India during the next few years will create a demand for larger quantities of industrial explosives. Judging from the rate at which the use of these explosives is increasing, it may be estimated that the value may reach 60 lacs of rupees in 10 years' time.

Explosives for Sporting Purposes

The total value of such explosives, used yearly, is 11 lacs of rupees, and this, in 10 years' time, may reach the figure of about 15 lacs.

Fireworks

The total value of fireworks used which may be reached in 10 years may be estimated at Rs. 15 lacs.

POSSIBILITIES OF MANUFACTURE IN INDIA

The main difficulty, at present, to the establishment of a big, explosives factory in India is the want of basic chemicals, none of which is available in India except potassium nitrate and charcoal. If this difficulty is overcome and the permission of the Government be forthcoming, there is no reason why explosives cannot be satisfactorily manufactured in India.

MANUFACTURE OF INDUSTRIAL EXPLOSIVES

Basic chemicals. Appendix XI. shows the quantities of basic chemicals required for the manufacture of Industrial explosives per year. In Appendix XII is given a list of basic chemicals required for the manufacture of fireworks. If an all round development in the manufacture of chemicals takes place as expected, most of these chemicals would be available locally.

Skilled labour. This is not available at present as Indian science graduates have no opportunity of getting the required training in India, as the manufacture of explosives at present in India is in the hands of the Government, who employ mostly European Staff for their superior establishments. The scheme of sending Indian Science graduates abroad for training or importing foreign experts temporarily for training Indian Staff is also not likely to solve the problem. .The best solution appears to be that discussed below under "capital".

Capital. The capital required for running an Industrial explosives factory in India may be estimated at Rs. 50 lacs. In order to get over the difficulty of suitable staff for the factory as discussed above, it is suggested that in the beginning at least half of this may be obtained from a leading explosive manufacturing English Company, which supplies mainly the present demand of India. This will serve three purposes:—(1) The English Company which invests the capital will work out its own patents under its own experts; this will ensure a ready sale of the products, which will be put on the market under the same old trade names, which have established a reputation. (2) In consideration of about half the capital to be provided by India, the English Company might be induced to train Indians in various branches of the industry. (3) There will be a sort of binding on the foreign experts to run the factory efficiently. After a certain number of years, the English Company might be paid off and asked to retire.

Site. A central factory for industrial explosives would need about 200 acres of land, which must be situated in a cool place near a flowing river and railway, but at least 5 miles away from big towns. In order to reduce railway freight the factory should be located near the coal fields of Bengal or Central Provinces.

MANUFACTURE OF FIREWORKS

Fireworks factories may be started in different parts of India where there is a large demand, near big cities. The capital required is comparatively small of the order of Rs. 50,000 or less. Such factories manufacturing sparklers are already running successfully in Western India, and attempts should be made to

start them in other parts of India. This industry will thrive better if the present Government restrictions on the storage and transport of sparklers be removed or modified so as to bring them in line with those operating for safety matches, where the risk of fire and explosion is actually greater.

There is a considerable production of other kinds of fireworks by cottage industries scattered throughout the country.

The main bulk of the imported fireworks consists of squibs and crackers, mainly from China and Japan, where these are made on cottage industry basis. Materials—cheap craft-paper and gunpowder, required for this industry are available in India, and the required machinery which is simple can also be made here. This industry can therefore be very well started in this country.

MILITARY EXPLOSIVES

The Government of India manufactures or imports the whole requirement. A list of the chemicals required is given in Appendix XIII. It would be possible to manufacture most of these chemicals in the country.

SECTION VII.

ORGANIC ACIDS, INDUSTRIAL SOLVENTS, AND PLASTICS

(a) The available import figures for acids are given below:

Acids.	1934-35	35-36	36-37	37-38	38-39
Acetic (Pyroligneous)	1,68,000	1,69,000	1,30,000	1,74,000	1,41,000
Carbolic	35,000	51,000	24,000	30,000	43,000
Citric	1,23,000	1,41,000	84,000	1,39,000	1,79,000
Oxalic	80,000	1,37,000	1,03,000	85,000	1,19,000
Tartaric	1,59,000	2,07,000	1,46,000	89,000	1,53,000
Other sorts	3,39,000	3,58,000	3,50,000	4,43,000	3,95,000

As for production, no organic acids are prepared in India. Regarding solvents, ethyl alcohol is chiefly produced in India. Methyl alcohol, ether, chloroform, acetone and other solvents are produced to a very limited extent.

RAW MATERIALS

(b) Regarding potentialities for the manufacture of organic acids it should be said that plenty of raw materials in the shape of coal tar, oils and fats are available in India. Other solvents can be produced by synthesis.

With the increased development of sugar industries, plenty of raw materials in the shape of molasses for the production of alcohol is available. Now it is only necessary to well organise this fermentation industry so that in addition to alcohol other solvents like fusel oil and glycerol can also be produced from this industry. From the soap the available lye which is being generally wasted at present should be fully utilised for the recovery of glycerine. Organised efforts should be made to win all the hydrocarbons, phenolic and basic solvents, from the tar. Wood distillation industry will form a good source, if well organised, for solvents like methyl alcohol and acetone. Enough plant raw materials are available for the production of furfural and allied solvents.

REFINING OF PETROLEUM

Though the subject does not primarily come within the purview of this sub-committee, we feel that in view of its relation

to industrial solvents, the National Planning Committee should seriously take up the problem of establishing Petroleum Refineries in India. In most free countries in the world, crude petroleum is imported as such and then refined inside the country. The refineries of Italy supply 50 per cent of the country's gasoline requirements by distilling imported crude. In India the Tariff Board has also recommended this :—"It stands to reason that all these countries would not have deliberately established refineries, if it was cheaper to import the refined product....Further two important branches of petroleum business today, namely refining and marketing, are almost entirely in the hands of Companies registered outside India. A substantial part of this business can be converted into a genuine Indian enterprise if refineries are established in India, and oil is marketed by Indian companies with rupee capital. It might be possible to encourage the establishment of refineries in India by Rupee Companies, if the present import duty on crude oil of 2 as. 6 pies per gallon was retained, but was remitted in favour of a genuine Rupee Company subject, of course, to the usual condition on which a bounty is granted and such other control as the Government may impose. No doubt if this business was undertaken by any company outside the big oil Trusts, attempts would be made by inferior competition to bring it to grief, but it should not be impossible for the Government to afford protection against such competition."

PLASTICS

Although this subject also does not fall directly within the purview of this sub-committee, in view of the increasing importance of plastics in industry and the intimate relationship of the plastics industry with the chemical industries, we would like to make the following suggestion. The Lac Research Institute, at Ranchi, which is doing work of great importance on the manufacture of plastics from lac, should be expanded and converted into a Central Institute for research work connected with the industry of the manufacture of plastics in general.

GENERAL

With reference to some of the terms of reference for this sub-committee, we would like to make the following general observations, which apply more or less to all the chemical industries:—

1. Labour, skilled and unskilled, required for the various industries.
   i. **Unskilled labour.** Unskilled labour is available in the country in plenty. The cheapness of labour is a favourable factor for Indian industry. Besides, the so-called unskilled labour is really intelligent, and is capable of being trained to the required standard.
   ii. **Skilled labour.** Highly trained technical men are available for most of the industries. Further, the large number of research chemists turned out by various scientific institutes and colleges would be available for absorption in the various industries. The cheapness of skilled labour is a factor which counter-balances partly in the case of some of the industries, particularly the fine chemical industry. In a few cases, where skilled technical labour is not available, experts may be brought over from abroad for starting the Industry, and running it in the initial stages on short term contracts, on the definite understanding that they shall fully train up Indians for the running of the industry, during their term of service. In other cases, where necessary, young Indians who have received the best available training here, may be sent abroad for training for the particular industries.
2. We are in full agreement with the National Planning Committee in the view that Chemical Industry is a key Industry which should be either owned or controlled by the State.
3. As the Chemical Industry is a Key Industry, which must be fostered at all costs, the various branches of this Industry should be given adequate state protection in one or more of the following ways, as required :—
   (i) Prohibition of Imports. Imports of finished products should be prohibited for a certain number of years except in special cases, where they may be imported

under license from the Government. This would apply to substances like dyes and drugs.

(ii) Protective import duty for a definite period, e.g., in the case of heavy chemicals.

(iii) Free import of materials and chemicals which are not available in the country, e.g., in the case of compounds of Arsenic, Lead, Sulphur, Tin, etc.

APPENDIX. I.

NAMES OF FIRMS.	HEAVY CHEMICALS PRODUCED
1. Messrs. D. Waldie & Co., Ltd.	Sulphuric, Hydrochloric and Nitric Acids; sulphates of Alumina and Iron; Alum; Zinc chloride solution; Lime-sulphur; Red lead and White lead.
2. The Bengal Chemical & Pharmaceutical Works Ltd., Bengal.	Sulphuric, Hydrochloric and Nitric Acids; Alum, Sulphates of Alumina, Iron and Magnesium.
3. Dr. Bose's Laboratory Ltd., Bengal.	Sulphuric, Hydrochloric and Nitric Acids; Alum; Alumino-ferric; Copperas Magnesium and Sodium Sulphates; Lime-sulphur solution.
4. The Bengal Acid and Chemical Manufacturing Co., Ltd., Bengal.	Hydrochloric and Nitric Acids; Sodium sulphate and Soda crystals.
5. The India Chemical and Pharmaceutical Industries, Bengal.	Sulphuric, Nitric and Hydrochloric Acids; Alum; Sulphate of Alumina, Alumino-ferric, Copperas and Sodium Sulphate.
6. Messrs. Perry & Co., Madras.	Sulphuric, Hydrochloric and Nitric Acids; Sulphates of Magnesium, Iron and Sodium; Calcium Superphosphate.
7. The Madras Alkali and Chemical Works, Ltd., Madras.	Hydrochloric Acid, Sodium Sulphate, Soda, Ammonium Chloride, Copper Sulphate, Iron Sulphate and Zinc Chloride.
8. The Mysore Chemicals & Fertilisers, Ltd., Belugola, Mysore.	Synthetic Ammonia; Sulphuric Acid; Ammonium Sulphate.
9. The Eastern Chemical Co., Ltd., Bombay.	Sulphuric, Hydrochloric and Nitric Acids; Sulphates of Iron, Sodium and Magnesium and Soda crystals.

10.	The Dharmsjee Morarji Chemical Co., Ltd., Bombay.	Sulphuric, Nitric and Hydrochloric Acids; Sulphates of Alumina, Sodium and Magnesium; Alum; and Calcium Superphosphate.
11.	The Ramco Chemical Works, Bombay.	Sulphuric, Hydrochloric and Nitric Acids; Sulphates of Alumina, Iron, Magnesium and Sodium.
12.	The Baroda Chemical Works, Baroda.	Sulphuric, Nitric and Hydrochloric Acids; and Sodium Sulphate.
13.	The Cawnpore Chemical Works, Ltd., U.P.	Sulphuric, Nitric and Hydrochloric Acids; Alum; Sulphates of Alumina and Iron.
14.	Messrs. Shambu Nath and Sons, Ltd., Punjab.	Sulphuric and Hydrochloric Acids; Alum; Aluminoferric and Copper Sulphate.
15.	The Pioneer Magnesia Works, Ltd., Bombay.	Magnesium Chloride, Magnesium Sulphate, Potassium Chloride, Magnesium Oxide and Carbonate, Calcium Chloride and Sodium Sulphate.
16.	The Tatanagar Chemical Co., Ltd.	Artificial Red Oxide.
17.	The Mysore Iron & steel Works, Bhadravati.	Methanol, Methylacetate and Calcium Acetate.
18.	The Tittaghar Paper Mills, Ltd., Bengal.	Caustic Soda, Bleaching Powder.
19.	Messrs. Lever Bros. (India) Ltd., Bengal.	Glycerine.
20.	The Tata Oil Mills Co., Ltd.	Glycerine.
21.	The Tata Iron & Steel Co., Ltd.	
22.	The Bengal Iron Co., Ltd.	
23.	The Indian Iron & Steel Co., Ltd.	Sulphuric Acid and Ammonium Sulphate.
24.	Loyabad Coking and By-products Recovery Plant.	
25.	The Bararee Coke Co., Ltd.	
26.	The E. I. Railway Coke Plant.	

27.	The Tin Plate Co., of India Ltd.	Sulphuric Acid.
28.	The Tata Chemicals Ltd., Orissa.	Propose to manufacture Soda Ash, Caustic Soda, etc.
29.	The Imperial Chemical Industries (India) Ltd.	Propose to manufacture almost all heavy chemicals.

APPENDIX II

I. DYES

(1) Direct Colours

		lbs.	Rs.
(1)	Cotton Red 4BX	12,283	15,354
(2)	„ „ B Conc. 4s	28	
(3)	„ „ 12B	15	45
(4)	„ Brown A	971	1,942
(5)	„ Rubine B	1,023	1,614
(6)	Sky Blue FF	600	713
(7)	Direct Black	100	125
(8)	„ „ KN	168	168
(9)	„ Deep Black RW Extra	224	252
(10)	„ „ „ E Extra Conc.	582	723
(11)	„ Yellow 5G	86	430
(12)	„ Fast Yellow 3G & 4GL	10	
(13)	„ „ Orange EG	156	
(14)	„ „ „ ER	184	
(15)	„ „ Brilliant Orange S	112	
(16)	„ „ „ „ RN H.C.	784	
(17)	„ „ Violet FFBN & BB	300	
(18)	„ Light Violet E 342	88	320
(19)	„ Fast Brown B2R Conc.	2,352	
(20)	„ „ „ B	660	1,124
(21)	„ Brown M	1,389	3,475
(22)	„ Brilliant Blue BR Conc.	850	
(23)	„ Blue 2B Extra Conc.	429	631
(24)	„ Sky Blue 6B	37	62
(25)	„ Deep Blue 4BX	275	
(26)	„ Green B 160%	340	575
(27)	„ „ G	50	70
(28)	Benzo Fast Scarlet 4BS	483	966
(29)	„ „ Orange S	3,134	4,705
(30)	„ „ Violet O	1,336	2,080
(31)	„ Blue 3BX	1,524	3,048
(32)	„ Red 12 B	42	105
(33)	„ Rhoduline Red B	40	96
(34)	„ Purpurine 4B 150	1,500	1,593
(35)	Sirius Orange F	17	60
(36)	„ Violet BB	341	1,025

		lbs.	Rs.
(37)	Sirius Violet 2BL	60	184
(38)	„ Red 4B	60	146
(39)	„ Supra Yellow G	100	450
(40)	„ „ „ RT	285	460
(41)	„ „ Brown BR	459	865
(42)	„ „ „ T	56	
(43)	„ „ „ G	138	620
(44)	„ „ Blue G	5	
(45)	„ „ „ FFGL	56	
(46)	„ „ „ FFRL	518	
(47)	„ „ „ 6G	266	1,180
(48)	„ „ „ BRR Pdr.	58	174
(49)	„ „ „ F3GL	34	27
(50)	„ „ Violet FFR	20	131
(51)	„ „ Red Violet R	15	33
(52)	„ „ Orange 3R	330	1,050
(53)	„ „ „ 7G	10	19
(54)	„ „ Grey G	6	22
(55)	Khalif Yellow SYZ	2,380	5,950
(56)	Chrysophemine G. Highly Conc.	1,474	3,685
(57)	„ W. Extra	98	260
(58)	„ G2 30%	233	580
(59)	„ R 250	378	1,028
(60)	„ H.C.	550	1,512
(61)	Delta Purpurine 5B Conc.	2,633	4,608
(62)	Chlorazol Fast Rubine R. Conc.	1,456	
(63)	„ Corinth GWS	300	
(64)	„ Rose 4BS	250	
(65)	„ Fast Helio BKS	959	1,800
(66)	„ Fast Heli 2 RKS	136	578
(67)	„ Black E Extra	112	
(68)	„ Deep Black Ex.	47	62
(69)	„ Yellow 6GS	40	
(70)	„ Sky Blue FFS	281	420
(71)	„ „ „ FF 250%	1,072	2,460
(72)	„ Cutch Brown GRR Pdr.	128	283
(73)	„ Brown MS	765	1,530
(74)	„ „ WB	400	660
(75)	„ „ LFS	210	420
(76)	„ „ 3RX & BS	1,890	4,225
(77)	„ Green GS	80	98
(78)	„ Azurine GS Pdr.	58	103
(79)	„ Fast Scarlet 4BS Pdr.	62	107
(80)	„ „ Orange AR	239	571
(81)	„ „ „ AGS	214	535
(82)	„ „ Yellow B	145	199
(83)	„ „ „ 6GS	35	160

		lbs.	Rs.
(84)	Chlorazol Fast Yellow 5GKS	19	41
(85)	„ „ „ CH Spl.	5	14
(86)	„ „ „ FG 250	112	250
(87)	„ „ „ 6GBN	1,220	1,925
(88)	„ „ Red KS	15	33
(89)	„ „ Blue 5GKS	30	69
(90)	„ „ Brown B	442	995
(91)	„ „ Pink BKS	14	32
(92)	Diazo Corinth B	1,120	
(93)	„ Direct Black BH	48	71
(94)	„ Fast Scarlet NL BS	434	760
(95)	„ „ Orange NS 200%	9	21
(95)	„ Direct Black BH (double)	310	580
(97)	Myrio Saturmine	1,670	2,500
(98)	Para Pure Green 2 G	400	
(99)	Para Brilliant Green 4B	140	
(100)	„ Red Violet RH	356	
(101)	Oxydiamine Carbon TE	865	1,080
(102)	„ Orange R (H.C.)	74	150
(103)	„ „ RH Conc.	112	224
(104)	„ Pure Blue 6 BO	134	293
(105)	„ Violet BF	32	46
(106)	Congo Cornith G	29	44
(107)	„ „ B	869	1,367
(108)	„ „ B Pdr.	701	1,044
(109)	„ Red	1,225	765
(110)	„ „ 12B	30	78
(111)	„ H Dark	24	15
(112)	Diamine Catechlime G	2,164	3,750
(113)	„ Catchin GB	290	358
(114)	„ Green B	112	154
(115)	„ „ KB Ex.	10	14
(116)	„ „ G	248	310
(117)	„ Black	617	579
(118)	„ Orange G	63	145
(119)	„ „ FS	1,307	2,513
(120)	„ Catedin G	120	225
(121)	„ Bordeaux VBI	193	300
(122)	„ „ B	207	411
(123)	„ Brown KLG	56	108
(124)	„ „ B	22	46
(125)	„ Crysolite Green	4	5
(126)	„ Blue 3R	29	90
(127)	„ „ RW	27	47
(128)	„ SKY Blue FF 220%	137	288
(129)	„ Brilliant Orange SS	220	343
(130)	„ Fast Orange EG	305	610

		lbs.		Rs.
(131)	Diamine Fast Orange ER Pdr.	88		288
(132)	„ „ Scarlet GFF	17		33
(133)	Damine Fast Blue FFB	153		425
(134)	„ „ Scarlet 4BS	424		758
(135)	„ „ Violet FFRN	20		99
(136)	„ „ „ FFBN	43		147
(137)	Oxamine Pure Blue 6BO	132		330
(138)	Pluto Brown GG	1,496		2,430
(139)	Aceto Purpurine 8B	390		825
(140)	Brilliant Sky Blue 8G	775		2,060
(141)	„ Diazol Yellow NSJ Extra	2		13
(142)	Duron Red 2BS	50		212
(143)	Fast Diazol Orange NS	112		252
(144)	Serapis Red	1,281		2,469
(145)	„ Yellow	2,165		3,859
(146)	Heliotrope	40		60
(147)	Paramine Brilliant Pink 8Bs	40		100
(148)	Thioflovin S	92		450
(149)	Pontamine Black	300		490
(150)	Tobulglene Red O	2		5
(151)	Chicago Blue R	48		79
(152)	Trigol Green BGP	18		21
(153)	Dyriamanoine BF	38		564
(154)	Chlorantine Fast Black L	658		650
(155)	Pyramine Orange R	250		1,080
(156)	Madrasi Fast Scarlet	34		78
(157)	Cotonerol AB Ex.	1,214		1,475
(158)	Blue	2,645		
(159)	Violet	2,679		
(160)	Brown	3,062		
(161)	Orange	2,651		
(162)	Yellow	1,282		
(163)	Red	8,103		
(164)	Black	3,465		
(165)	Corinth	975		
(166)	Green	546	From	
(167)	Bordeaux	2,617	158 to 163	
(168)	Pink	236		60,000
	Consumption of 4 other mills, who have supplied only the total figures			74,875
				18,796
				20,000
				20,000
	(2) Acid Colours.			
(1)	Palatine Fast Yellow GRN	625		2,648
(2)	„ „ Claret RN	614		3,830
(3)	„ „ Blue GGN	392		1,967

		lbs.	Rs.
(4)	Anthra Chrome Black P.B.	1,413	1,943
(5)	Coomassee Navy Blue 2RNS	1,232	1,579
(6)	Quinoline Yellow ASIW	675	1,526
(7)	Sulphon Cyamine 5R	321	649
(8)	Rhodamine B Extra	295	1,220
(9)	Acid Violet 4BC	50	141
(10)	Patent Blue AF	50	100
(11)	Eosine A	50	234

(3) Naphthols.

		lbs.	Rs.
(1)	Naphthols AS	16,358	24,600
(2)	„ AS—BO	3,503	10,509
(3)	„ AS—G	439	2,310
(4)	„ AS—TR	22,008	1,22,500
(5)	„ AS—LB	1,312	9,184
(6)	„ AS—SG	5,835	39,400
(7)	„ AS—SR	100	500
(8)	„ AS—SW	2,851	6,235
(9)	„ AS—S	713	6,950
(10)	„ 31855 (New)	158	1,422
(11)	„ AS—BS	4,503	9,006
(12)	„ AS—OL	970	3,150
(13)	„ AS—JR	552	3,170
(14)	Brenthol Ct	2,479	14,255
(15)	„ MN	5	12
	Consumption of 3 other mills, who have supplied only the total figure	..	65,000
			1,467
			2,212

(4) Fast Salts.

		lbs.	Rs.
(1)	Fast Scarlet R (H.C.)	5,416	8,125
(2)	„ Bordeaux GP (H.C.)	2,240	7,980
(3)	„ Violet B	672	5,420
(4)	„ Red B	448	1,165
(5)	„ „ TR	448	1,165
(6)	„ „ Salt FR	276	795
(7)	„ „ „ Re.	5	12
(8)	„ Scarlet Salt R	9	18
(9)	Variamine Blue B	5,600	24,850
(10)	Trivasol Orange GR	87	245
(11)	„ Red TR	70,577	1,49,765
(12)	„ „ B	10,132	26,595
(13)	„ Bordeaux GP	17,675	66,280
(14)	„ Red FR	1,984	5,455
(15)	„ Bordeaux 46061	305	1,330
(16)	„ Scarlet RH	1,718	2,900

		lbs.	Rs.
(17)	Trivasol Blue BB	4,742	29,045
(18)	„ Violet B	10,430	65,190
(19)	„ Orange GC	391	785
(20)	„ Scarlet R	8,623	12,935
(21)	„ Orange RD	25	90
(22)	„ Red RC	641	1,485
(23)	„ „ TS	1,792	3,805
(24)	„ Violet B(New)	1,799	13,795
(25)	„ Scarlet GG	2,093	2,615
(26)	„ Corinth V	19	55
(27)	„ Red GL	6	10
(28)	Brenthol Fast Red Salt TR	6,928	15,155
(29)	„ „ „ „ B	7	20
(30)	„ „ „ Scarlet Salt R	56	85
(31)	„ „ Bordeaux Salt GP	4	10
(32)	„ Red Salt GL	36	55
		lbs.	**Rs.**
(33)	Arisol Red B	9,408	23,520
(34)	Salt GP	148	410
(35)	„ B	275	720
(36)	„ TR	590	1,255
(37)	Black K	100	275
	Consumption of two other mills	1,332	2,935
		6 tons	30,000
		Total ..	5,06,350

5. Fast Bases.

		lbs.	Rs.
(1)	Trivamine Red TR	4,051	29,369
(2)	„ „ RBE	1,429	10,713
(3)	„ „ B	2,324	8,715
(4)	„ Bordeaux GP	224	1,974
(5)	Orange GR	672	1,890
(6)	„ Scarlet Re.	52	117
(7)	Red B Base	448	1,680
(8)	„ TR	5	30
(9)	„ GL	1,400	3,238
(10)	Scarlet Re. Base	2,656	6,640
(11)	Bordeaux GP	263	2,170
(12)	Garnet GBC	164	215
		Total ..	66,766

6. Rapid Fast Colours.

		lbs.	Rs.
(1)	Rapidogen Violet B	6,863	51,472
(2)	„ Brown IB	1,302	13,670
(3)	„ Scarlet R	112	896
(4)	„ Red B	224	1,850
(5)	„ „ R	1,208	7,000
(6)	„ Gree B	134	1,088
(7)	„ Blue B	1,238	9,700
(8)	Rapid Fast Brown GGH	3,698	38,829
(9)	„ „ „ IBH	125	1,562
(10)	„ „ Orange RH	427	2,562
(11)	„ „ Bordeaux RH	224	2,380
(12)	„ „ „ IB	126	1,275
(13)	„ , Yellow GGH	4,967	32,240
(14)	„ „ Red RH	1.562	9,782
(15)	„ „ Blue B	150	1,200
(16)	Indigosol Blue 04B	1,730	11,387
(17)	„ Green IB	3,951	92,493
(18)	„ Violet ARR	774	14,054
		Total ..	2,94,425

		lbs.	Rs.
(1)	Nova Reduit DKT New	2,800	9,416
(2)	Irasamine G	1,235	11,663
(3)	Brilliant Greet Chrystel	121	271
(4)	Malachite Green XLSL	8	15
(5)	Bright Silk Blue	47	106
(6)	Methyl Violet BB	168	303
(7)	Madras Turkey Red	377	1,294
(8)	Rhodamine Blue	5	34
(9)	Turquish Blue G	9	52
(10)	Alizarine Red II ABB	168	118
(11)	„ III AG 40% paste	5,000	6,250
(12)	„ IP 20% paste	336	211
(13)	„ Red RAG 20% paste	56	33
(14)	„ „ V 20% paste	56	38
		Total: ..	29,834

8. Basic Colours.

(1)	Rhodamine 6GDN	690	7,590
(2)	„ B Extra	393	1,650
(3)	„ Blue 5B	477	3,220
(4)	„	26	130
(5)	„ 6GH Extra	39	565

		lbs.	Rs.
(6)	Brilliant Green Crystals	412	824
(7)	Methyl Violet	508	2,032
(8)	„ „ 2B	75	112
(9)	„ „ 5B	448	1,120
(10)	„ „ BB	1,422	2,485
(11)	„ Blue	112	462
(12)	„ „ BB Extra	112	310
(13)	Astraphloxin	132	1,089
(14)	Auramine O	1,706	2,560
(15)	„ OS	72	108
(16)	Tannin Blue MO	280	980
(17)	Mordant Blue CVD	56	280
(18)	Victoria Blue 4R	40	120
(18A)	„ „ B(HC)	1,799	5,397
(19)	„ „ BS	44	99
(20)	„ „ BA	38	90
(21)	„ „ B 150	144	432
(22)	Malachite Green Crystals	692	1,211
(23)	„ „ 4 Extra	808	1,414
(24)	„ „ 25 SE sml. crystals	127	254
(25)	„ „ Crystals AS	37	74
(26)	Astraphlosein FF	369	4,154
(27)	Diamond Green G	313	726
(28)	Green	303	520
(29)	Purple	44	110
(30)	Methylene Blue 2B	45	80
(31)	„ „ BB Extra	112	310
(32)	Alizarine Cyanol Violet	12	150
(33)	Bright Blue 5B	441	1,100
(34)	Rubine Extra	18	33
(35)	Royal Green LC	50	100
(36)	Thioflavine TT	6	34
(37)	Cresyl Blue BBS	30	270
(38)	Safraime TS	5	205
(39)	Violet Methyl 2B Conc. pd.	65	134
	Simplex mills	1,162	4,375
	Century Mills	1,932	3,865
	New Great Easter Coloba Land and New City Mills	1,120	2,500
	Total ..		53,274

9. Sulphur Colours.

		lbs.	Rs.
(1)	Sulphur Black	25,760	4,830
(2)	„ „ KNBO	1,680	420

		lbs.	Rs.
(3)	Sulphur Black NGS	7,216	2,255
(4)	„ „ OB Ex.	7,772	1,700
(5)	Immedial Carbon BO	1,15,991	28,998
(6)	„ „ NNG	41,046	7,696
(7)	„ Green GG	233	815
(8)	„ „ G	5	4
(9)	„ Olive B	40	45
(10)	„ „ 2G	20	23
(11)	„ „ GG	200	225
(12)	„ Blue U 300	40	58
(13)	„ „ Green CV	30	47
(14)	„ Direct Blue B	106	145
(15)	„ „ „ RL (H.C.)	130	227
(16)	„ New Blue FBL Ex.	75	155
(17)	„ Black Brown D Extra	249	498
(18)	„ Red Brown 6R	363	1,022
(19)	„ Yellow Brown 3R Ex.	136	200
(20)	„ Dark „ D	112	220
(21)	„ „ „ A Pdr.	54	68
(22)	„ Maroon B	245	642
(23)	” Khaki 6G Pdr.	22	48
(24)	” Yellow D	36	30
(25)	” ” GG	15	35
(26)	” Cutch G RR	253	411
(27)	” Orange R Extra	448	896
(28)	” Indogene GCL Conc.	448	1,092
(29)	” Black V Extra 67/100	346	325
(30)	Indo Carbon CL	24,525	45,985
(31)	” ” CLG	1,643	3,800
(32)	Thiogene Brown GR	539	943
(33)	” Khaki N	341	810
(34)	Thionyl Black TF 110	7,006	1,752
(35)	” Orange R 150 Pdr.	4	7
(36)	” Red Brown 6 RS	5	13
(37)	Natural Sulphur Cordeaux 2R	56	98
(38)	KRYOGENE Violet 3 RX Pdr.	20	68
(39)	Thioxinc Black NGS (double conc.)	1,423	445
(40)	Thionine Black NSGD Conc.	7,060	1,765
(41)	Katigen Red Brown 3R Ex Conc.	56	144
	Consumption of 3 other mills, who have supplied only the total figures.		60,000
			6,837
			8,600
		Total	1,84,387

10. Vat Colours.

		lbs.	Rs.
(1)	Indanthrene Brilliant Green GG	15,648	4,45,988
(2)	„ „ „ 4G	33	1,090
(2)	„ „ „ GG Supra	1,530	9,056
(4)	„ „ „ B	471	15,425
(5)	" " Violet RR	2,153	53,825
(6)	" " " 4R	764	17,572
(7)	" " " RR	392	9,800
(8)	„ „ „ RK PDr.	8	200
(9)	" " " R Ex. Paste	16	32
(10)	" " Orange PK	30	930
(11)	" " Pink R Suprafi	664	2,656
(12)	" " " R Pdr.	28	658
(13)	" " Blue RCL Pdr.	108	972
(14)	" " GG Pdr.	147	4,850
(15)	" Blue RSN	3,613	38,840
(16)	" " BC	2,355	25,602
(17)	" " GCD Pdr.	1,566	16,443
(18)	" " NRSN	5,182	57,002
(19)	" " GC D Paste	224	810
(20)	" " Green G G	672	21,903
(21)	" " " B	112	3,650
(22)	" " " 4G	56	1,826
(23)	" " GCN	6	98
(24)	" Ptg. Blue Supra	2,944	14,550
(25)	" Brown R	485	18,915
(26)	" " GG	1,714	49,706
(27)	" " G	444	12,544
(28)	" " FFR	638	18,502
(29)	" " BR	1,097	33,735
(30)	" " 3GT	120	3,360
(31)	„ „ GR Pdr.	67	695
(32)	„ „ R Pdr.	112	3,100
(33)	" " R RD Paste	116	377
(34)	" Ptg. Brown RRD Paste	4,040	16,738
(35)	Indanthran Ptg. Brown B Supra	2,513	25,565
(36)	" Direct RB Pdr.	5,600	60,000
(37)	" " Black RR	2,473	37,095
(38)	" " " RB	2	19
(39)	" Golden Orange G	554	11,000
(40)	" " " 3G	720	20,160
(41)	" Orange RRT	47	1,410
(42)	" " 7RK	56	980
(43)	" " RR	14	168

		lbs.	Rs.
(44)	Indanthran Yellow 3GF	359	6,462
(45)	" Brown 3G	30	960
(46)	" " GF	15	428
(47)	" " 3R	39	1,149
(48)	" " 5GK	8	85
(49)	" " FFRK	3	84
(50)	" " Brown 3G Pdr.	116	3,700
(51)	" " G Pdr.	55	1,210
(52)	" Olive 3G	406	7,714
(53)	" " Green B	9	99
(54)	" " R	193	4,053
(55)	" Violet RK	70	1,400
(56)	" DK Blue BO	20	400
(57)	" Dark Blue BO	262	3,010
(58)	" " " BOA Pdr.	18	196
(59)	" " Brown GG	336	9,744
(60)	" Rubine R	272	8,160
(61)	" Grey M	24	768
(62)	" " BG	365	12,045
(63)	" " 3B	142	5,560
(64)	" " 3B Pdr.	21	785
(65)	" Corinth RK	13	364
(66)	" Red FFB	104	3,120
(67)	" " Brown 5RF	15	555
(68)	" " " GR	12	204
(69)	Indanthren Khaki GGC	45	630
(70)	" " M Paste	336	800
(71)	" Pink 3BF	16	400
(72)	" " RS	34	578
(73)	" Navy BF	142	1,988
(74)	" Turquoise Blue 3GK	2	42
(75)	" Green BG	122	3,696
(76)	" Black BB	1,705	13,070
(77)	" " RR	896	13,140
(78)	" Ptg. Black B Supra	6,552	84,357
(79)	" Magenta B	160	3,040
(80)	Caledon Jade Green G 2100	1,018	33,330
(81)	" " " 2G 2100	580	19,000
(82)	" " " B 2100	252	700
(83)	" Blue GCDN 800	471	7,065
(84)	" Dark Blue BM 800	139	1,500
(85)	" Blue RCN 1000	1,154	16,300
(86)	" " ICN Pdr.	727	2,900
(87)	" " GCD 800	7	91
(88)	" D Blue 2RD	5	65
(89)	" Blue RC 200 paste fine	376	1,363
(90)	" " R 200 " "	190	499

		lbs.	Rs.
(91)	Caledon Brown RT	220	5,280
(92)	" " GRD 800	277	3,878
(93)	" " GG Pdr.	84	2,000
(94)	" " 2G Pdr.	213	4,726
(95)	" " G 800	173	4,498
(96)	" Golden Orange 3G 800	59	1,652
(97)	" " " G Pdr.	146	2,774
(98)	" " " G 800 Pdr.	288	5,000
(99)	" Olive R 800	22	462
(100)	" Black 2B 800	5	45
(101)	" Khaki O225	4	70
(102)	" Yellow 5G 300	33	396
(103)	Indigosol Blue IBC Paste	37	217
(104)	" Green IB	378	9,072
(105)	" Violet ARR	18	342
(106)	" Red IFFB	7	161
(107)	" Brilliant Pink 13 B	5	80
(108)	" Scarlet IB	6	68
(109)	" Golden Yellow IRK Pdr.	10	170
(110)	" Grey IBL	7	112
(111)	Algol Yellow G6N	367	8,074
(112)	Brilliant Indigo R	99	966
(113)	" " BR	30	270
(114)	Indigo 6% grains	2,020	3,030
(115)	Cibanone Violet 2RP Pdr.	143	3,938
(116)	" Blue RSN "	625	6,560
(117)	" Brown GR "	102	2,958
(118)	" Black 2B "	865	7,960
(119)	" Olive 2R "	27	530
(120)	" Golden Orange 2G Pdr.	171	3,249
(121)	" " " 2R	94	2,940
122)	Vat Dark Blue BO Pdr.	150	1,425
(123)	Vat Black BB	360	2,700
(124)	Peradone Blue FC	190	6,840
(125)	" " RSNR and FC	113	1,440
(126)	" Brilliant Violet KR	64	1,692
(127)	" Violet RR	106	2,968
(128)	" Yellow GG	118	2,773
(129)	Ciba Brilliant Pink R Pdr.	12	276
(130)	Dark Blue BO Pdr.	280	3,010
(131)	Hydron Blue RR Pdr.	296	939
(132)	" Pink FF Pdr.	108	1,674
(133)	Durindon Blue 4BCS paste	3	8
(134)	Durindon Pink FB 400 Pdr.	2	25
(135)	Tetra Blue 2 B	960	6,720
(136)	Soledon Jade Green XS	600	8,297
(137)	" Golden Yellow GKS	100	2,301

		lbs.	Rs.
(138)	Soledon Blue BC paste	3	12
(139)	" Orange 4 RS	5	25
(140)	" " RS	4	58
(141)	" Pink FFS Pdr.	8	200
(142)	" Brown GS Pdr.	3	39
(143)	Brilliant Indigo R Paste	1,378	13,100
(144)	Cibr Blue RN		
	Consumption of 5 other mills, who have supplied only the total figures ..		18,000
			48,105
			90,726
			2,00,000
			41,333
	Total		18,73,800

11. Aniline Salts.

		lbs.	Rs.
(1)	Aniline Salt	4,693	4,000
(2)	" Oil	408	400
	Total		4,400

II. TEXTILE AUXILIARY AGENTS.

1. Synthetic Wetting Agents

		lbs.	Rs.
(1)	Igepon T	36,192	53,000
(2)	" J Pdr.	673	850
(3)	Nekal BX Dry	6,562	10,255
(4)	Gardinal WA	6,720	7,560
(5)	" CA	5,163	6,775
(6)	" A	224	335
(7)	Lisapol T	8,120	8,120
(8)	" T Pdr.	5,723	20,385
(9)	" A	2,151	1,388
(10)	Igepal C	1,126	1,480
(11)	Jadoo	11,200	3,700
(12)	Houghton's Acid No. 1	1,344	1,850
(13)	" " " 2	480	540
(14)	Methanol CB	2,016	3,025
(15)	Ultravan WX	1,344	1,345
(16)	Pentrone T	1,560	1,760

	lbs.	Rs.
Consumption of 2 mills, who have supplied only the total figures		1,400
		5,000
Total		1,28,348

2. Sulphated Oils.

		lbs.	Rs.
(1)	Turkey Red Oil	1,28,226	16,023
(2)	Monopol Brilliant oil	20,848	10,424
(3)	" Soap	7,592	4,750
(4)	Turkey Red Oil 200%	2,923	1,462
(5)	" " " 50% NQ	73,436	9,179
(6)	Troxem Diatol	1,683	1,891
(7)	" " Soap	4,050	1,140
(8)	Senol Super	1,464	1,820
(9)	Servoline Soap	467	290
(10)	Prestabit oil	14	16
(11)	" " V	14	30
(12)	Pearlaxol B	300	150
	Consumption of one mill	10 tons.	5,000
	Total		52,185

3. Kier Boiling Assistants

		lbs.	Rs.
(1)	Nuva LA Double Conc.	9,946	7,460
(2)	„ B	1,120	1,400
(3)	Sulpha fenchelon	4,382	3,288
(4)	Sodium Carbonate	90	540
(5)	„ Hydroxide	20	260
(6)	„ Silicate	80	480
(7)	Caustic Soda	1242 cwts.	15,525
(8)	Soda Ash	1462 cwts.	8,406
(9)	Trecol	3,117	4,675
(10)	Pine Oil	672	1,764
(11)	Mineral Turpentine	84 gals.	126
(12)	Ludigol pdr.	284	421
(13)	Laventine KB	6	8
(14)	Perminal KB	452	452
(15)	Trivapol KB	720	360
	Total		45,165

4. Mercerising Agents

(1)	Mercerol	224	588
(2)	Perminal merc.	1,211	1,287

		lbs.	Rs.
(3)	Emulsifier	560	840
(4)	Gas Ammonia	65	114
(5)	Sulph. Mercerol	1,251	1,485
(6)	Shirlacrol	266	133
(7)	Humetol CX	649	1,622
		Total	11,069

5. Products For After Treatment

		lbs.	Rs.
(1)	Bar Soap	1,800	1,800
(2)	Developer H	102	286
(3)	Solidogen BSE	69	102
		Total	2,183

6. Level Dyeing Auxiliaries

		lbs.	Rs.
(1)	Peregol OX	2,133	3,175
(2)	Dekol	13,415	3,600
(3)	„ pdr.	226	100
(4)	„ „	300	375
(5)	Peregol O	10,507	17,163
(6)	Humectol CX	952	1,490
(7)	Glue	784	238
(8)	Glue	4 cwts.	170
(9)	Kalepol	6,771	3,880
(10)	Leovatine (Sandoz)	168	504
		Total	32,655

7. Diazopon A. Etc.

(1)	Diazopon A	5,650	8,400
(2)	Paradurol	560	750
(3)	Radio Matin T53B	112	340
(4)	Diazophone	400	500
(5)	Eunaphthol AS	250	250
(6)	Dispersol	84	108
		Total	14,040

8. Paraffin Emulsions

(1)	Ramasit I	16,237	14,210
(2)	„ K	400	590
(3)	Paraffin base	56	7

		lbs.	Rs.
(4)	Glossite SR	1,344	2,016
(5)	Paranol	3,600	1,350
		Total	18,173

9. Softening Agents

(1)	Cloth Glaze	672	126
(2)	„ Softener	672	210
(3)	Ewasol	5,376	4,368
(4)	Pearl paste	1,544	420
(5)	Softnol	672	252
(6)	Stearine white triple past	4,215	5,750
(7)	„ Soap	29,245	5,315
(8)	Cirrasol LC	341	400
(9)	Soromine WF	1,137	2,129
		Total	20,970

10. Cellulose Derivatives

(1)	Tylose 4S	3 cwts.	558

11. Reagents for Chemical Finishes

(1)	Velan PF	904 cwts.	4,039

12. Antiseptics

		lbs.	Rs.
(1)	Salicyclic acid	224	280
(2)	Preventol liquid	122	244
(3)	„ solid I	219	438
(4)	Shirlan NA	1,092	2,170
(5)	Shirlan paste	1,605	2,355
		Total	5,487

13. Desizing Agents

(1)	Viveral E	27½ cwts.	5,465
(2)	„ „ Conc.	122	153
(3)	„ „ H.C.	1,023	2,046
(4)	Enzymol	5,227	10,454
(5)	Raidase (Super)	32	752
(6)	Novo Fermasol	4,076	16,943
(7)	Vemial E Conc.	672	1,092
(8)	Polysine N	543	670
(9)	Nokal BX dry	53	92
		Total	37,667

14. Solvents for Printing

			Rs.
(1)	Glycerine	7,236 lbs.	3,618
(2)	Glycerine A	178 cwt.	30,680
(3)	Tetracarint	3,299 lbs.	15,290
(4)	Turpentine	51½ drums	670
(5)	Pine Oil	3,332 lbs.	2,126
		Total	55,184

APPENDIX III.

CHEMICALS AND TEXTILE AUXILIARIES IMPORTED DURING THE CALENDAR YEAR 1937

	Quantity in Lbs.	Value Rs.
Alizarine (Dry) 40%	17,000	40,000
„ (Wet) 20%	2,270,000	1,600,000
Congo Red	2,500,000	1,308,000
Naphthols	1,347,000	1,181,000
Rapid Fast Colours	92,328	518,128
Bases	735,856	1,600,000
Other salts	1,305,600	1,985,000
Indigo	820,350	1,110,814
Vat Dyes (Paste)	185,960	701,056
„ (Powder)	908,266	13,787,900
Sulphur Black	4,622,511	965,300
Metanil Yellow	1,004,806	759,400
Auramine	....	....
Rhodamines	1,102	4,120
Aniline Salts	382,650	135,268
Others	5,374,332	8,588,117
	Total	40,000,000

15. Miscellaneous Auxiliary Agents

(1)	Tannic acid Conc. (Commercial)	195 cwt.	4,680
(2)	Kolepal New	3,134 lbs.	1,567
(3)	Tibalene NED	763 „	680
(4)	Katanol ON	2,166 „	3,385
(5)	Formaldehyde	7,919 „	1,980
(6)	Myrabolan Nuts	39 cwt.	88
(7)	Gum Tragon)		
(8)	„ Rotex)	5,376 lbs.	5,376
(9)	Gumfiner	12,000 „	8,250
(10)	Laventine KB)		
(11)	Pearlaxol)	56 „	63
(12)	Ceramine Sk	1,035 „	3,362
(13)	Eulysin A	112 „	175

(14)	Aktivin S	2,424	„	4,545
(15)	Chromoal SF	1,49,388	„	42,360
(16)	Gum Tragacanth	8,324	„	14,232
(17)	„ Light British	9,072	„	1,841
(18)	Lissolamine A	10	„	53
(19)	„ U	3	„	16
(20)	Amylose AN pdr.	22	cwt.	1,375
		Total		94,028

APPENDIX IV.

DIRECT COLOURS, INCLUDING CONGO RED

(Estimate of total requirement 2500 tons).

	Prices per lb. (in brackets)			Available figure lbs.	Estimate tons	Pure dyestuff tons.	Intermediates required tons.
1.	Congo Red (up to as. 12 according to strength)	Benzidine 184	Naphthionic acid 223 Naphthionic acid 223	2630	1000	754	Benzidine 200 Naphthionic acid 48
2.	Benzopurpurine 4B (Re. 1|4 conc.)	Tolidine 202	Naphthionic acid 223 Naphthionic acid 223	12433	270	199	Toluidine 56 Naphthionic acid 12
3.	Direct Black E. (Re. 1-4 conc.)	Benzidine 184	H acid 319-Aniline 93 m-Phenylene diamine 108	7107	360	286	Benzidine 68; H acid 117; Aniline 34; m-phenylene diamine 40
4.	Chrysophenine (Rs. 2-8 conc.)	Diaminostibene disulphonic acid 370	Phenol 94 then ethylated Phenol 94	8560	180	136	"Stilbene" acid 74; Phenol 38
5.	Benzo Fast Orange S (Re. 1-8)	J acid dye		8649	90	50	J acid 25
6.	Direct Brown M Rs. 2-8 also some P.)	Benzidine 184	Y acid 239 Salicylic acid 138 (The Brown B is from Phenyl-Y-acid)	2154	70	49	Benzidine 14; Y acid 18; Salicylic acid 11
7.	Diazo Black BH conc. (Re. 1-8)	Benzidine 184	Y acid 239 H acid 319	2645	55	40	Benzidine 9; Y acid 11 1|2; H acid 16
8.	Benzo Blue 3BX	Tolidine 202	H acid 319 H acid 319	2228	50	35	Tolidine 8; H acid 24
9.	Sirius Violet BP (Rs. 2-13)	A -acid dye Diphenylurea disulphonic acid (eq. p-phyenylene diamine 216)	Y acid 239 Phenyl-J acid 315 (J acid 239) 223	1660 plus 2381	50	35	P-Phenylene diamine 6; J acid 7; Y acid 7 (eq. Aniline 5.1|2)

APPENDIX IV.

DIRECT COLOURS, INCLUDING CONGO RED----(Contd.)

(Estimate of total requirement 2500 tons).

Prices per lb. (in brackets)			Available figure lbs.	Estimate tons.	Pure dyestuff tons.	Intermediates required tons.
10. Diamine Bordeaux, Congo Rubine and Congo Corinth (about Re. 1-8)	Benzidine	Crocein acid 223 Benzidine Crocein|Naphthionic acid 223 Naphthionic acid N. W. acid 223	3018	50	37.1|2	Benzidine 10; Crocein acid 10 (eq. B naphthol Naphthionic acid 10; N.W. 5 (eq. aniline 4)
11. Direct Green P|G (Re. 1-6)	Benzidine	H acid 319 P-NO2-aniline 138 Phenol|salicylic acid 94|138	1384	50	35	Benzidine 8; H acid 13; P-NO2 Aniline 6; Phenol 2; Salisyclic acid 2.½
12. Pluto Drown GG (Re. 1-10)			1496	35	24	m-Phenylene diamine 10
13. Deltapurpurine 5B conc. (Re. 1-12)	Benzidine 184	2:6 Naphthylamine sulphonic acid 223 2:7-Naphthylamine sulphonic acid 223	2633	30	23	Benzidine 6; 2:6|7 acid 15; (Y-Naththol 9.½)
14. Sky Blue FF (Rs. 2-4)	Dianisidine 234	2 S acid 319 2 S acid 319	2574	25	18	Dianilidine 4.1|2; 2 S acid 12
15. Diamine Catechin G (Re. 1-14)			1574	25	18	m-Phenylene diamine 10
16. Benzo Violet O (Re. 1-9)	Benzidine 184	J. Acid 239 J. Acid 239	1660	25	17.1|2	Benzidine 4.1|2; J Acid 11.1|2
17. Benzo Fast Scarlet 4B	Aniline 93—Urea NH2—acetanilide	J. Acid 504—P-(eq.J. Acid 478) (eq.93 aniline)		15	10	Aniline 2.1|2; J acid 6

APPENDIX IV.

(Estimated total requirement 250 tons.)

		Available figure lbs.	Estimate tons.	Pure Dye tons.	Intermediates—tons
Victoria Blue B (highly conc.) 3|-)	Dimethylaniline 242 and Phenyl a-naphthylamine 219	2018	40	28	Dimethylaniline 14 and Phenyl a-naphthylamine 12
Methyl Violet BB (1|8)	Dimethylaniline 363	2686	35	28	Dimethylaniline 28
Malachite Green (1|12)	Dimethylaniline 270 and	846			Dimethylaniline 12
Brill Green (2|-)	Benzaldehyde 106	482	35	28	Dimethylaniline 2.1|2
Rhoduline Blue 5B (6|12)	Dimethylaniline 484 and Benzaldehyde 212				Benzaldehyde 10
Auramine O (1|8)	Dimethylaniline 242	1778	35	25	Dimethylaniline 20
Rhodamine 6GDN 500 p.c. (11|-)	Phthalic anhydride 148 and m-ethylaminophenol 137x2.	729	15	9	
Rhodamine 3G (Irisamine G)	Phthalic anhydride 148 and m-dimethylaminophenol 137 C-amino-p-cresol 123	1235 2678	8	6	
Rhodamine B (4|3)	Phthalic anhydride 148 and m-diethylaminophenol 165x2 eq. 274	714	10	4	
Astraphloxine FF (8|4)		501	12	6	
Methylene Blue B (1|12)	Dimethylaniline 242	448	5	4	Dimethylaniline 3
Bismarck Brown, Magenta and the rest			10	4	Dimethylaniline
					Total dimethylaniline 81 tons

APPENDIX IV.

VAT COLOURS

(Estimated total requirement 350 tons calculated as powder)
(Solubilised Vats are included and dealt with simultaneously)

				Available figure lbs.	Intermediates required: estimate tons.	Pure dyestuff tons.	Anthraquinone	Benzanthrone
Indanthren Brilliant Green B, GG, etc. 28|8)	Dimethoxydibenzanthrone derivatives 674	and Benzanthrone	460	21864	105	60	—	40
		Anthraquinone	416					
Indigosol Green 18 (23|6)	Disodium sulphonate of leuco-dimethoxydibenzanthrone			4671				
Indigosol Green IGG	(new) from GG							
Blues: (10|12) (a)	Derivatives of Indanthrone	Total		17082	85	50	43	—
(10|12) (b)	RSN — Indanthrone 442	and RCL		10280				
(10|8) (c)	BC — 3:3'-Cl Indanthrone 512	Anthhraquinone	416	3754				
	GCD — 4-4'—Cl „ 512			3940				
Indigosol Blue IBC paste	From Blue BC 968	—not collected						
Indanthren Direct Black RB (10|12)	From dinitrodibenzanthrone	Benzanthrone	460	5602	50	30	—	21
		546		336 11906				
Indanthren Direct Black RB (15|-)								
Indanthren Black BR (9|4)		Anthraquinone	416	2935				

(Estimated total requirement 350 tons calculated as powder)
(Solubilised Vats are included and dealt with simultaneously)

				Available figure lbs.		Intermediates required: estimate tons.	Pure dyestuff	Anthraquinone	Benzanthrone
Indanthren Brown G (26|-)	Di-p-aminobenzoyl-amido doanthraquinone 478	Anthraquinone	208	617					
Indanthren Brown GG (39|-)		,,	208	2292 1097		32	20	9	—
Indanthren Brown BR (30|12)	Probably similar in type								
Indanthren Brill. Violet RR (25|-)	Halogenated isodibenzanthrones 526	Benzanthrone	460	2871	) 3635	17	10	—	8
Indanthren Brill Violet 4R (23|-)		Anthraquinone	416	764					
Indanthren Golden Orange 3G (28|-)	Carbazoles from 1:1'-dianthraquinonylamines	G plus 3G eq. Anthraquinone	416	1669					
Indanthren Brown R (23|8)				702 215	2586	10	6	3.1|2	—
Indanthren Olive R (21|-)									
Brown GR and Khaki GG are similar in type									
Indanthren Dark BG				891		5	3	—	3
Various concentrations)		Benzanthrone	460						
	Dibenzanthrone 454	Anthraquinone	416			Anthraquinone Benzanthrone Anthraquinone			71 74 eq. 67
						Total Anthraquinone			138

APPENDIX IV.

NAPHTOLS

(Estimate of total requirements eq. 600 tons. Rapid Fasts, Rapidogens and Rapidazols are included for convenience under Naphtol AS)

			Available fig. lb.	Estimate tons.	Pure dyestuff tons.	Intermediates required tons. H-N acid.
1. Naphtol AS (Re. 1-8)	2:3-Hydroxynaphthoic acid 188	plus Aniline 93	16358	231	231	165 Aniline 82
2. „ AS-BS (Rs.2)	„ „	plus m-Nitraniline 138	4508	140	140	85 m-Nitraniline 63
3. „ AS-TR (Rs. 5-12)	„ „	plus 5 Cl o-toludine 142	24487	85	85	61 5 cl o-toluidine 39; (eq. o-toluidine 28)
4. „ AS-BO (Rs. 3)	„ „	plus B-Naphthylamine 143	3503	50	50	30 B-Naphthylamine 23
5. „ AS--SW (Rs.2-3)	„ „	L naththylamine	2851	30	30	18 a-Naphthylamine 14
6. „ AS-SG		plus p-Anisidine 123	5835	25		
Other Naphtols						
7. Naphtol AS-LB (Rs.)7	2-Hydroxycarbazole -3-carboxylic acid 227 plus P-Chloraniline 128		1312			
8. „ AS-PL (Rs. 3-4)	2:3Hydroxynaphothoic acid 187 plus O-toludine 107		970			
9. „ AS-C (Rs. 5-4)	Acetoacetic acid 2x102 eq. 204 plus o-tolidine 202		439	10	8	Total 2:3-hydroxynaphthoic acid 3 eq. 352 tons B-naphthol required eq. 270 tons.
10. „ AS-S						

APPENDIX IV.

BASES AND SALTS

(Estimate of total requirement eq. 900 tons).

			Available fig. lbs. Base plus Salt eq. Total base	Estimate Base tons. plus Salt eq. Pure base tons.	Intermediates tons.
1. Scarlet R; RC (Base Rs. 2-3-6) highly conc. salt Rs. 1-8)	4-Nitro-2-aminoanisole Base eq. 1-3 highly conc. salt	168	2708 plus 15813 eq. 7979	220 plus 210 eq. 290	
2. Red TR (Base Rs. 5-14) (Salt Rs. 2-2)	5-Chloro-2-aminotoluene hydrochloride	179	4056 plus 80355 eq. 20123	25 plus 200 eq. 65	39 o-toluidine
3. Red B (Base Rs. 3-12) (Salt Rs. 2-6)	5-Nitro-2-aminoanisole	168	2722 plus 20443 eq. 6800	55 plus 40 eq. 65	
4. Bordeaux GP (Base Rs. 8-1) (Salt High conc. Rs. 3-9)	3-Nitro-4-aminoanisole Base eq. 1-3 highly conc. salt	168	4876 plus 20063 eq. 7175	* plus 36 eq. 18	
5. Garnet GBC (Base Rs. 1-3-6) (Salt Rs. 1-5)	0-Aminoazotoluene hydrochloride	262	164 plus 0 eq. 164	25 plus 12½ eq 27.1|2	11 o-toluidine
6. Red GL (Base Rs. 2-4) (Salt Rs. 1-10)	3-Nitro-4-aminotoluene	152	1400 plus 0 eq. 1400	10 plus 5 eq. 11	8 P-Toluidine
7. Violet B (Salt Rs. 6-4)	6-Benzoylamido-4-methoxy 3-aminotoluene	256	0 plus 12901 eq. 2580	0 plus 12½ eq. 2.1|2	
8. Orange and others				9 plus 25 eq. 14	
				Total 350 plus 551 eq. 493	

APPENDIX IV.

SULPHUR COLOURS

(Estimated total requirement 2400 tons)

	Sulphurisation of	Available figure lbs.	Estimate tons.	Pure dye tons		
Sulphur Black	L-nitrophenol 203	238554 plus 240000	2000	—	m-Dinitrochlorobenzene	650
Indocarbon CL conc.	Carbazole-inophenol	26168	60	30	Carbazole 13 plus p-NH2-phenol 8	
Hydron Blue	„	298	71	40	„ 17 plus „ 11	
					30	19
Immedial Green GG and rest			100	40		

APPENDIX IV.

MISCELLANEOUS

				Estimate tons as an average 1200 all conc.	Pure dye tons	Intermediates-tons
Alizarine (various conc.) mostly 20 per cent 40 per cent (1|-|6)	1.3-Dihydroxyanthraquinone 240				240	Anthraquinone 208
Indigo (60 per cent grains) (up to 1|10) Ciba Blue 2B Indigosol 0; 0.B				525	315	Ph glycine 362 eq. to Aniline 223
Aniline Salt	C(H) .....HCI 130			90	90	Aniline 65
Metanil Yellow	Metanilic acid 173	———	diphenylamine 169	eq. to 375 375	282	Metanilic acid 130; Diphenylamine 127
Orange II	Sulphanilic acid 173	———	B-Naphthol 144	eq. to 350 25	18	B-Aniline; B-Naphthol 7
Brill. Crocein M (—"gutal")	Aniline 93	——— Aniline 93	——— G. Acid 303	eq. to 5515 20	14	B-Aniline 5; B-Naphthol 4
Ponceau 2R (Acid Scarlet 2R)	—Xylodine 121	R. Acid 303		eq. to 479 17	12	m-Xyline 3; B-Naphthol 4
Various other acid and chrome dyes				50	35	
(Nigrosines, etc.)				25		

APPENDIX V.

IMPORTS OF DYES IN INDIA

1935-36, 1936-37 and 1937-38

Name and distribution.	Quantity—Lbs. 1935-36	1936-37	1937-38	Value (Rs.) 1935-36	1936-37	1937-38
1) Cochineal:						
Bengal	1	1	5	390	175	389
Bombay	950	1341	600	94095	131024	66265
Sind	18	18	—	1797	1766	—
Madras	25	124	7	3159	1022	597
Total	994	1484	612	99259	143287	67251
2) Cutch and Gambier:						
Bengal	38360	31411	69459	443758	382994	930778
Bombay	1298	1430	2289	37881	48777	71911
Sind	1	—	80	42	—	2300
Madras	576	413	2938	14078	7193	57698
Burma	1962	1800	—	67449	55367	—
Total	42197	35054	74766	563208	494331	1062687
Coal Tar Dyes:		....lbs.....				
3) Alizarine, dry not exceeding 40%:						
Bengal	4274	2500	2500	8388	4542	4473
Bombay	950	3500	350	1656	5888	548
Sind	3562	3450	1250	6342	5805	1918
Total	8786	9450	4100	16386	16235	6939
4) Aliz-dry over 40%:						
Bengal	28	—	—	80	—	—
Bombay	3193	5208	4712	8275	15478	12765
Sind	4000	5432	3948	9676	16237	10819
Total	7221	10640	8660	18031	31715	24584
5) Aliz. moist not ex. 16%:						
Bengal	58240	67088	56896	32475	37079	28344
Bombay	53312	145488	81536	27099	69444	37821
Sind	20384	46256	37520	10606	21765	17016
Madras	8960	20048	5600	4511	10812	2560
Total	140896	278880	181552	74691	139100	85741

Name & distribution.	Quantity—Lbs 1935-36	1936-37	1937-38	Value (Rs.) 1935-36	1936-37	1937-38
6) Aliz. moist, over 16% not ex. 20%:						
Bengal	61936	61264	72688	41323	38141	42097
B'bay	1163996	1300239	978432	707834	748824	528541
Sind	489788	452368	482738	295591	266425	254819
Madras	175060	208780	224776	100848	117953	122457
Total	1890780	2022651	1759624	1145596	1171343	947887
7) Aliz. moist over 20%:						
Bengal	10640	—	224	6843	—	258
Bombay	81648	103364	96544	101744	135437	100612
Sind	58352	99232	86800	72055	112156	86032
Madras	107072	22400	122080	120607	23059	126806
Total	257712	224996	305648	301249	270652	313708
Total for Alizarine:						
Bengal	135118	130852	132308	89108	79762	75172
B'bay	1303099	1557799	1161574	846608	975071	681260
Sind	576086	606738	613246	394270	422388	370604
Madras	291092	251228	352456	225966	151824	251823
Total	2305395	2546617	2259584	1555953	1629045	1378859
8) Congo Red:						
Bengal	310553	271819	250685	242377	192658	166442
B'bay	1895437	1909432	1515074	1029942	1020715	803998
Sind	230672	234643	213607	111894	117200	104742
Madras	106537	38180	127229	51028	19730	61822
Burma	34340	8520	—	23833	4484	—
Total	2577539	2482594	2106595	1459074	1354787	1137004
Coupling Dyes of Naphthol Group :						
9) Naphthol:						
Bengal	116617	91027	313857	277538	207194	481618
Bombay	729763	550671	800202	2022035	1595184	2010889
Sind	1961	4780	8448	4317	7909	15059
Madras	121908	105679	236139	300983	290828	552944
Burma	6984	1176	—	17936	4284	—
Total	977233	753333	1358646	2622809	2105399	2060570
10) Rapid Fast Colours: (Rapid Salts):						
Bengal	3900	1112	5050	22941	6958	32483
Bombay	45042	41904	68393	248809	225296	403788
Sind	2000	3000	3650	8780	13658	17798
Madras	8400	6412	10665	40990	33382	49704
Total	59342	52428	87758	321520	279294	503773

Name & distribution.	Quantity—Lbs. 1935-36	1936-37	1937-38	Value—Rs. 1935-36	1936-37	1937-38
11) Bases:						
Bengal	88719	49345	188317	208054	110383	352881
Bombay	390185	252008	389895	801601	522216	852192
Sind	1672	1606	2498	11183	9823	17047
Madras	76281	86075	196347	167093	174147	448340
Burma	8684	840	—	21682	840	—
Total	565541	389874	777051	1209613	817409	1670460
12) Other Salts:						
Bengal	87092	65380	121890	145239	115034	188856
Bombay	833293	707860	931861	1166080	1049825	1488567
Sind	2100	9800	11672	2607	10872	15500
Madras	78284	73520	106374	110900	103437	145137
Burma	2054	4480	—	2370	7378	—
Total	1002823	861040	1174797	1427196	1286546	1838060
Vat Dyes:						
13) Indigo:						
Bengal	58577	36064	31310	86412	54597	46629
Bombay	712551	508944	599463	944298	656914	837455
Sind	230042	128450	159186	360684	186272	227014
Madras	819943	120793	114950	140010	153905	156532
Burma	100800	5600	—	151200	7000	—
Total	1213913	799851	904900	1692604	1058688	1267630
14) Carbazole Blue:						
Bombay	47312	30658	48601	101314	87027	108995
Bengal	16128	29542	71222	33334	60691	156967
Madras	16808	16826	25610	32481	37149	58201
Total	80248	86026	145433	167129	184867	324163
15) Other Sorts. (Paste):						
Bengal	2192	700	42	7802	2153	123
Bombay	58923	70244	113040	202659	244114	602966
Madras	154954	98625	63621	314899	272590	162174
Total	216069	169569	176703	525360	518857	765263
16) Other Sorts (Powder):						
Bengal	57912	69581	107090	693203	866080	1216775
B'bay	482293	493901	558438	7301845	7404562	9472396
Sind	1000	500	300	4544	2331	1268
Madras	69336	107194	119101	928200	1272724	1444766
Burma	—	10	—	—	160	—
Total	610535	671186	784929	8927792	9545857	12135205

Name & distribution.	Quantity—Lbs. 1935-36	1936-37	1937-38	Value—Rs. 1935-36	1936-37	1937-38
17) Sulphur Black:						
Bengal	278314	239932	360643	90731	72067	75683
B'bay	3687667	2383111	3815291	1004808	514563	792235
Sind	15123	21112	46004	3181	4202	11068
Madras	338940	481044	537400	77582	81524	102380
Burma	34720	17920	—	9310	3920	—
Total:	4354764	3143119	4759338	1185612	676276	981366
18) Metanil Yellow:						
Bengal	135212	102932	152100	133707	97024	137508
Bombay	518719	629064	520968	493833	476857	438919
Madras	43300	46160	52952	31132	30850	34384
Sind	51402	97554	88272	35978	66749	57702
Burma	5900	1300	—	4337	712	—
Total	754533	877010	814292	698987	672192	668513
19) Auramine of Concentration of 15% and less:						
Bengal	—	—	—	—	—	—
Bombay	15256	—	—	21953	—	—
Sind	700	280	—	1805	—	—
Madras	560	—	—	577	—	—
Burma	—	—	—	—	—	—
Total	16516	280	—	24335	337	—
20) Rhodamines (Carthamines) concentration of 15% and less:						
Bombay	—	1653	—	—	6145	—
Sind	2262	—	—	4290	—	—
Madras	1120	—	—	4141	—	—
Total	3382	1653	—	8431	6145	—
21) Aniline Salts:						
Bengal	62937	49588	188650	25495	19093	70661
Bombay	51007	72338	62730	17593	26172	21935
Sind	29120	76164	30240	11175	26428	10925
Madras	92277	96480	92269	33656	41121	30986
Burma	5600	5600	—	2275	2081	—
Total	240941	300170	373889	90194	114895	134507
22) Other Coal Tar Dyes:						
Bengal	484622	323037	403129	782795	505263	635353
B'bay	4156572	2899117	4071122	6591084	4565992	6842284
Sind	391154	305537	367657	415474	344785	390630
Madras	317015	237458	322513	463703	361558	542056
Burma	119514	48790	—	167615	65778	—
Total	5468877	3813939	5164421	8420671	5843376	8410323

Name & distribution.	Quantity—Lbs. 1935-36	1936-37	1937-38	Value—Rs. 1935-36	1936-37	1937-38
Total of Coal Tar Dyes:						
Bengal	1837893	1460911	2326293	2838737	2388957	3637151
B'bay	14927119	12117704	14656652	22794462	19370653	25357879
Sind	1535294	1510164	1547774	1370182	1212954	1239357
Madras	1820749	1765674	2357626	2933341	3024769	4041249
Burma	318596	94236	—	400558	96637	—
Total	20446651	16948689	20888345	30337280	26093970	34275663
23) Myrobalan extracts	——Cwts.——					
Bombay	23	—	—	236	—	—
Madras	—	—	7	—	—	67
Total	23	—	7	236	—	67
24) Saffron:	——Lbs.——					
Bengal	—	809	—	—	5055	—
Bombay	33955	29029	23058	677943	806368	888307
Sind	1100	550	138	5802	4699	3743
Madras	178	305	585	1721	7403	13421
Total	35233	30684	23781	685466	823525	904471
25) Other Sorts:						
Bengal	3301	6348	27271	73626	118490	353051
Bombay	2427	8046	10377	92439	313419	247334
Sind	2336	3673	2753	25399	56152	30511
Madras	9105	8253	30057	162454	158417	355961
Burma	1	170	—	67	1107	—
Total	17170	26490	70458	353985	647585	986857
Total for dyeing substances:						
Bengal				3356430	2895671	4921369
Bombay				23697055	20670241	26631696
Sind				1403222	1275571	1275911
Madras				3114753	3208104	4468993
Burma				468074	153111	4468993
Total				32039434	28202698	37297969

APPENDIX VI.

INTERMEDIATES REQUIRED (In tons per annum.)

(Estimates are in excess of calculated figures in order to allow for a margin of expansion).

NITROBENZENE. 1,500 made up as follows:

93	for Metanilic acid (130).
430	Benzidine (320)
834	Aniline (630)
1357.	

ANILINE. 800 (above mentioned) as follows:

46	for Directs
82	Naphthol AS (231)
65	Aniline salt (90)
223	Phenyl glycine (362)
123	Diphenylamine (127)
64	Dimethylaniline (81) plus Diethylaniline (2½)
27	Orange II and Crocein M.
630.	

DINITROCHLOROBENZENE	700.
m-PHENYLENEDIAMINE	60.
m-NITROANILINE	70.
PHENOL.	55.

(This quantity would be much greater if other requirements, such as salicyclic acid, aspirin, synthetic resins, etc. are taken into consideration).

B-NAPHTHOL. 500 made up as follows:

35	for J and Y acids (32 plus 29)
270	Hydroxynaphtholic acid (352)
23	B-Naphthylamine (23)
16	Directs.
40	Acid dyes (this figure is probably very inadequate)
384.	

OTHER NAPHTHALENE DERIVATIVES. 1000 made up as follows :

Phynyl-a-naphtkylamine	12.
H acid	170.
a-Naphthylamine	14.
2 S acid	12.
N. W. acid	5.
Naphthonic acid	630.

PHTHALIC ANHYDRIDE. 250 (as in the case of phenols, this figure would be much greater, if other requirements, such as synthetic resins, plasticizers, etc. are taken into account).

ANTHRAQUINONE 500 made up as follows:

208	for Alizarine.
138	Vats.
346.	

TOLUIDINE AND TOLUIDINE DERIVATIVES. 300 made up as follows :—

74	for Diaminostilbene disulphonic acid.
64	Toluidine.
78	o-Toluidine.
8	p-Toluidine.
10	Benzaldehyde.
234.	

CARBAZOL. 30.

APPENDIX VII.

RAW MATERIALS

	Benzene Tons.	Naphthalene Tons.	Toluene Tons.
Congo Red	170	276	—
Benzopurpurine 4 B.	—	70	52
Direct Black E.	115	47	—
Benzo Blue 3 BX	—	—	7
Chrysophenine	31	—	37
Naphthols	102	273	26
Fast Scarlet R.	135	—	—
Fast Red TR	—	—	34
Sulphur Black	255	—	—
Basic dyes (except Rhodamine)	52	—	—
Anthraquinone Vat dyes	53	85	—
Alizarine	78	128	—
Indigo	187	—	—
Aniline salt	54	—	—
Metanil Yellow	173	—	—
	1405	889	156
	Plus		
Hydron Blue and Indocarbon.	14		
	Carbazol.	30	

APPENDIX VIII

SYNTHETIC DRUGS (ORGANIC)

No.	Name	Annual consumption Quantity Kilos in thousands	Price Rs. in thousands	Remarks (N.A.—Not available)
	(1) Narcotics and general anaesthetics.			
1.	Ether	50	100	
2.	Methylal	15	150	
3.	Paraldehyde	2	6	
4.	Acetophenone	1.5	..	N.A.
5.	Ethyl chloride	3	72	
6.	Ethyl bromide	3	24	
7.	Chloroform	75	225	
8.	Chloral hydrate	3	12	
9.	Chloralose	..	..	N.A.
10.	Chloral formamide	0.2	5	
11.	Butyl Chloral hydrate	0.5	13	
12.	Chloretone	0.06	6	
13.	Sulphonal	0.1	3	
14.	Trional	15 lbs.	0.25	
15.	Tetronal	0.3	—	N.A.
16.	Urethene	0.3	..	N.A.
17.	Bedonal	0.3	..	N.A.
18.	Adalin	..	..	N.A.
19.	Veronal	..	..	N.A.
20.	Bromural	..	..	N.A.
21.	Neuronal	..	..	N.A.
22.	Evipan tubes	25 doz.	7	
23.	Phanodorm	0.255	2.5	
24.	Phanodorm-calcium	..	..	N.A.
25.	Luminal	0.1	38.4	
	(2) ANTIMALARIALS.			
1.	Atebrin	0.03	200	
2.	Plasmochin	0.01	100	
3.	Quinine troposan	..	..	N.A.
4.	Quinine stovarsol	..	..	N.A.
5.	Eu-quinine	0.1	13	

No.	Name	Annual consumption Quantity in thousands Kilos	Price in thousands Rs.	Remarks (N.A.—Not available)
6.	Ethyl ester of quinine (Aristoquine)	0.1	25	
7.	Quinine salicylate (saloquine	..	..	N.A.
	(3) NATURAL AND SYNTHETIC LOCAL ANAESTHETICS.			
1.	Cocaine	..	..	N.A.
2.	Tropacocaine	..	..	N.A.
3.	B-Eucaine	0.1	35	
4.	Stovaine tubes	900 doz.	28	
5.	Alypine	..	..	N.A.
6.	Novocaine	0.5	160	
7.	Anaesthesine	0.025	2.5	
8.	Nirvanine	..	..	N.A.
9.	Cyclopropane	..	..	N.A.
10.	Holocaine	..	..	N.A.
11.	Eccaine	..	..	N.A.
	(4) ANTIPYRETICS AND ANALGESICS			
1.	Acetanilide	5	33	
2.	Exalgin	..	..	N.A.
3.	Phenacetin	4	48	
4.	Lactophenin	1	..	N.A.
5.	Antipyrine	3	60	
6.	Pyramidon	2	..	N.A.
7.	Benzoic acid	4	24	
8.	Salicylic acid	5	20	
9.	Methyl salicylate	25	150	
10.	Acetyl salicylic acid	40	300	
11.	Migraonin	..	..	N.A.
12.	Trigemin	..	..	N.A.
13.	Compral	..	..	N.A.
14.	Melubrin	..	..	N.A.
15.	Novalgin	..	..	N.A.
16.	Gardan	..	..	N.A.
	(5) ORGANIC ANTISEPTIC AND DISINFECTANTS.			
1.	Phenol	160	179	
2.	Salol	3	21	
3.	Resorcinol	1	9	
4.	Acetylresorcinol	0.15	..	N.A.
5.	Guaiacol	0.5	13.5	

No.	Name	Annual consumption Quantity in thousands Kilos	Price in thousands Rs.	Remarks (N.A.—Not available)
6.	Guaiacol carbonate	1.2	20	
7.	Potassium guaiacol sulphonate	..	..	N.A.
8.	Thymol	3	42	
9.	Beta-naphthol	3	42	
10.	Chloramine-T	0.3	1.5	
11.	Dichloramine-T	0.3	25.2	
12.	Halazone	0.3	21.6	
13.	Tribromphenol	0.3	12.0	
14.	Iodoform	1	14	
15.	Tetra-iodo pyrrol	0.3	..	N.A.
16.	Iodipin	0.15	..	N.A.
17.	Sozoiodol	..	..	N.A.
18.	Aristol	..	..	N.A.
19.	Loretin	..	..	N.A.
20.	Sajodin	..	..	N.A.
21.	Nosophen	..	..	N.A.
22.	Formaldehyde	300	600	
23.	Hexamine	15	45	
24.	Proflavine	..	..	N.A.
25.	Acriflavine	0.1	40	N.A.
26.	Malachite green	0.5	120	
27.	Cchinosol	..	..	N.A.
28.	Tannalben	..	..	N.A.
29.	Tannoform	..	..	N.A.
30.	Santalol	..	..	N.A.
31.	Santalol carbonate	..	..	N.A.
32.	Allosan	..	..	N.A.
33.	Betol	..	..	N.A.
34.	Dermatol	..	..	N.A.
35.	Collargol	..	..	N.A.
36.	Protargol	0.1	13.8	
37.	Hexylresorcinol	1.5	360	
38.	Quinosol	..	..	N.A.

APPENDIX IX

SYNTHETIC DRUGS

Detailed information regarding the following principal drugs, quantities consumed yearly, raw materials, economies of production, has been collected.

Acetyl salinylate acid.
Phenacetine.
Antipyrine.
Pyramiline.
Methyl salinylate.
Aloxyl, salvarsan and Neo Salvarsan.
Carbarsan
Anaesthesine.
Novocaine.
B. Euccaine.
Atebrin.
Plasmoguine.
Aristochin and Eu-quinine.
Chloral hydrate and chloralore
Sulphonal, Trional and Tetronal.
Phenolphthalen.
Adrenaline (Synthetic)
Argyrol, Protoirgol and argonein.
Iodoform.
Chloromine J, Dichloramine J, Halozene, and Saccharine.
Sulphanilamide and derivatives
Barbiturates.
Yatren or Loretin.
Proflavine, Acriflavine and Rivanol.
Mercurochrome.
Coramine.

APPENDIX X

Statistics. The following figures for import of explosives into British India have been collected from Government publications:—

(a) Military explosives. No figures are available.

(b) Industrial explosives. Import.

NAME	1936		1937		1938	
	lbs.	Rs.	lbs.	Rs.	lbs.	Rs.
Blasting gelatine	537900	455468	518450	438312	472400	373974
Gelignite & gelatine dynamite	1188150	969313	1282600	939671	1025250	707568
Dynamite*		39285				
Other nitro compounds	85420	48958	599856	397167	588140	329109
Blasting fuse Coils	726372 (2529342)	599043	744123 (2553732)	525102	712008 (2318694)	454687
Detonators No.	5157060	121823	8117100	243584	8857200	252131
Others.	157946	34243	353805	1195087	678415	549269
TOTAL		2268133		3738923		2666738

Approximate average figures for Blasting gunpowder manufactured in India in a year (i.e. six working months) are as follows:—

Place of manufacture.	Lbs.	Rs.
Bengal	50,00,000	1,25,000
Central Provinces. (Porasia)	3,00,000	75,000
Other places	2,00,000	50,000
TOTAL		2,50,000

(c) **Explosives and ammunition for sporting purposes.**

IMPORT.

NAME	1936		1937		1938	
	lbs.	Rs.	lbs.	Rs.	lbs.	Rs.
Gunpowder black	73308	42688	38250	25443	15350	15024
Smokeless powder	18100	20401	13590	23643	13235	13705
Others	835	764	23450	10919	57985	27664
TOTAL		63853		60005		56393

* Import of Dynamite has been prohibited since 1937.

	No.	Rs.	No.	Rs.	No.	Rs.
Cartridges filles for shotgun	11497586	777949	11948966	806553	13013434	883911
Ditto for rifles and others	3206004	167391	3605766	232785	7207887	411654
TOTAL.		945340		1039338		1295565

(d) **Fireworks:** IMPORT.

1936	26,70,066	7,65,353
1937	21,14,943	7,98,829
1938	28,79,774	9,81,834

The weight shown above are the finished fireworks of various designs. The weight of explosives contained in them is only a small fraction.

APPENDIX XI

List of principal basic chemicals required for the manufacture of Industrial explosives and sporting powder per year

Explosive.	Intermediate.	Basic Chemicals	Weight (tons)
Blasting gelatine 500 tons	Nitroglycerine 450 tons	Glycerine triple distilled	540
	Collodion 50. tons.	Nitric acid concentrated	1512
		Sulphuric acid 98%	1800
Gelatine Dynamite 1000 tons	Nithroglycernie 710 tons	Sulphuric acid fuming 20% SO3	1836
		Cotton waste	100
	Collodion 60 tons	Saltpetre	864
	Woodpulp 50		
	Saltpetre 180	Sulphur	7
Smokeless powder for cartridges 35 tons.	Nitroglycerine 13 tons	Charcoal	12
		Woolpulp	50
	Collodion 22 tons	Lead acetate	3.5
		Calcium azide solution 20%	6.5
Gunpowder for cartridges 36 tons.	——		
Detonator composition.	Lead azide 3 tons		
Blasting fuze Powder 36 tons.	——		

Blasting gunpowder which is made locally has not been considered. The quantity of acids shown in the last column includes recoveries from waste acids.

APPENDIX XII

List of basic chemicals required for the manufacture of Fireworks.

Alum.
Aluminium metal powder, coarse and fine
Antimony lumps.
Antimony sulphide, black, free from grit.
Arsenic sulphide, red and yellow, free from grit.
Barium chlorate.
Barium nitrate
Borax.
Calcium picrate.
Charcoal, wood for gun powder
Copper carbonates, basic.
Copper and potassium chlorate.
Copper sulphate.
Ethyl alcohol 90% (rectified spirits of wine)
Glue.
Gum arabic.
Iron and steel filings.
Lactose.
Lead sulphide technical.
Magnesium metal powder, coarse and fine.
Mercurous chloride.
Mercury thiocyanate.
Pitch, coaltar.
Potassium chlorate, recryst. (free from bromate).
Potassium nitrate, free from chloride and sodium salts.
Potassium perchlorate.
Rosin.
Shellac.
Silver fulminate.
Sodim nitrate, recryst.
Sodin oxalate.
Starch, maize or potato.
Strontium carbonate.
Strontium nitrate.
Sulphur roll.
Talc, fine powder.
Wax bees.

Wax bees
Wax paraffin.
Zinc metal dust.
Printing inks.
Cardboard, glaze board, mill board etc.
Paper various.
Thread cotton, linen, silk etc.
Wood for packing, various.

APPENDIX. XIII.

List of principal chemicals and other allied stores required by the Government of India for the manufacture of military explosives and stores for defence against gas warfare.

Acetic Acid.
Acetone, redistilled.
Alum
Aluminium metal powder, coarse and fine
Ammonia solution, sp. gr. 0.910.
Ammonium fluoride.
Ammonium nitrate, pure
Ammonium perchlorate
Ammonium persulphate
Ammonium picrate
Antimony lump
Antimony sulphide, black, free from grit.
Arsenic sulphide, red and yellow, free from grit.

Barium nitrate. Barium chlorate.
Barium peroxide
Bleaching powder, stable
Borax.
Boric acid
n-Butyl alcohol

Calcium azide
Calcium carbonate, precipitated
Calcium silicide
Calcium phosphide.
Carbon tetrachloride
Cesresin white
Charcoal, activated for gas masks
Charcoal, wood for gun powder
Chloropicrin, redistilled

Chloro-acetophenone (omega)
Collodion
Copper carbonate, basic
Copper sulphate
Cotton waste for gun cotton

Diethyl diphenyl urea (sym)
Dimethyl aniline for the manufacture of trinitrophenyl-methyl nitramine.
Diphenylamine.

Ether, sp-gr. 730
Ethyl alcohol 90 (rectified spirits of wine)
Ethyl alcohol absolute.

Glue.
Glycerine pure for nitroglycerine.
Gum arabic.

Hexamine.
Hydrochloric acid, technical and pure.
Hydrochloric acid, technical and pure.
Iron oxide, calcined, for incendiary bombs.

Kaolin.
Kieselguhr.

Lactose. Lead acetate pure.
Lead sulphide technical.
Litmus, best quality.

Magnesium metal powder, coarse and fine.
Magnesium oxide, light
Mercurous chloride.
Mercury metal pure.
Methyl alcohol pure
Methyl violet.
Mineral jelly.

Naphtha, coal tar.
Naphthalene.
Nickel Ammonium sulphate.
Nitric acid pure.

Oleic acid, technical.

Phenol crystals
Phosgene.
Phosphorous, read and yellow.
Pitch, coal-tar.
Potassium chlorate, recryst, (free from bromate)
Potassium nitrate, free from chloride and sodium salts.
Potassium perchlorate
Pumice stone
Pyridine technical

Rosin

Shellac
Silicon, fused lump and powder
Sodium carbonate (soda ash)
Sodium hydroxide, technical flake.
Sodium nitrate, recryst.
Sodium oxalate
Sodium silicate solution, technical.
Sodium thiosulphate
Starch, maize or potato
Strontium carbonate
Sulphur role
Sulphuric acid 95-98% and fuming (oleum)

Talc, fine powder
Toluene rectified
Turkey red oil

Wax bees
Wax carnauba
Wax chinese insect
Wax paraffin

Zinc metal dust

Disinfectant (Izal type)
Ferrous sulphate
Oils, animal, mineral and vegetable, various paints, enamels, lacquers, varnishes.
Printing inks.
Potassium ferrocyanide.
Sweet spirits or nitre.
Tincture of steel

Aluminium ingot, sheet, wire.
Brass bar, sheet, foil.
Copper bar, sheet, wire.
Cupronickel sheet.
Gun metal.
Iron, various.
Iron, various.
Lead refined and hard.
Nickel ingot (low carbon)
Phosphor bronze.
Silicon aluminium alloy.
Steel various
Tinned sheets of copper and iron, and iron wire.
Zinc ingot, sheet and galvanised iron sheet.

Asbestos goods various
Bakelite powder, sheet, varnish etc.
Cardboard, glaze board, mill board etc.
Celluloid sheet, cement, varnish etc.
Cotton wool.
Flass safety "triplex", discus.
Leather goods various.
Paper various
Rubber fabrics and goods various.
Textiles of cotton, linen, silk etc.
Thread cotton, linen, silk etc.
Wood for gun carriage and packing, various.

RESOLUTIONS OF THE NATIONAL PLANNING COMMITTEE ON THE INTERIM REPORT OF THE SUB-COMMITTEE ON CHEMICAL INDUSTRIES.

The National Planning Committee having considered the Interim report of the Sub-Committee on Chemical Industries, and pending the consideration of the final report of the Sub-Committee resolve as follows:

(i) In order that Planning may be accurate and effective a census of all forms of production, including cottage industries is necessary, and legislation for this purpose should be undertaken.

(ii) The rapid development of the dye-stuff industry is considered necessary and for this purpose it is recommended that a dye-stuff corporation should be formed as soon as possible. This industry is likely to require state-aid and it may be either subsidised and controlled by the State or owned by it. The Corporation should, in the initial stages, concentrate on the production of particular direct and basic colours, naphthols and bases, as indicated in the appendix to the Report. When the factory or factories under the Corporation start operations and produce dyes etc. of standard quality in sufficient quantity, the importation of dyes and intermediates should be prohibited license for special reasons.

(iii) The immediate establishment of a synthetic ammonia plant is recommended, with a view to making India self-sufficient with regard to synthetic nitrogen fertilisers. Such a factory should produce, at least, 50,000 tons of ammonium sulphate, which is approximately the present deficit in production in India.

(iv) The question of the proper use of coal should be considered later along with the recommendations of the Power and Fuel Sub-Committee. The N.P.C., however, agree generally with the recommendations that (a) the use of raw coal for domestic purposes, which involves waste and causes the smoke nuisance should be prohibited; (b) a sufficient quantity (3 million tons) of coal should be distilled to produce the soft coke necessary for this purpose; (c) the tar obtained from this process, as well as from other factories, now in use, should be processed to yield the road tar necessary for improving roads, ammonium sulphate for use as fertilisers, and the chemicals and intermediates essential for the dye and drug industries.

(v) The indigenous synthetic drug industry should be encouraged by a protective duty on synthetic drugs imported from abroad, and by suitable modification of the excise regulations relating to the spirits required for the drugs.

(vi) We recommend that an industry for the manufacture of explosives be started and that this be State-owned.

(vii) Crude petroleum should be imported into the country and subsequently refined in this country, in accordance with the recommendation of the Tariff Board on this subject, and the import of petrol and kerosene be subjected to a heavy duty.

(viii) Scientific research for industrial purposes is necessary for the proper utilisation of many products in manufactures. There should be a State Department for Industrial Research which should establish a National Chemical Laboratory as well as such other laboratories as may be considered necessary, encourage research work in Universities, and give facilities for doing research work in different parts of the country, including grants-in-aid to cooperative research work. The National Chemical Laboratory should especially investigate the possibilities of using various chemicals as substitutes, of obtaining necessary chemicals from the available resources, and of starting manufactures as suggested in the Interim Report.

(ix) Heavy chemicals should be protected, for a definite period from foreign competition. Such raw materials, and chemicals, which are not available in the country, e.g. sulphur, arsenic, lead, tin, etc., and some of their compounds should be allowed into the country free of import duty.

(x) The Chemical Industries, and more particularly the heavy chemical, and tar and petroleum distillation, and associated industries should be owned or controlled by the State.

A NOTE ON THE DYE-STUFFS INDUSTRY

The National Planning Committee, as its session in May 1940, approved of the recommendation of the Chemical Industries Sub-Committee that the rapid development of the dyestuff industry is considered necessary; and for this purpose it is recommended that a dyestuff coropration should be formed as soon as possible. This industry is likely to require State aid, and it may be either subsidised and controlled by the State, or owned by it. The Corporation should, in the initial stages, concentrate on the production of particular direct and basic colours, naphthols, and bases, as indicated in the appendix to the report. When the factory or factories under the Corporation start operations and produce dyes etc. of standard quality in sufficient quantity, the importation of dyes and intermediates should be prohibited under licence for special reasons.

The importance of the dyestuff industry to the economy of the country, in view of its position as a key industry on which the development of other branches of the chemical industry largely depends, is now fully realised in the country. Textiles constitute our premier industry and our annual import of dyes has been of the value of about 4 crores of rupees . This figure can be doubled if we provide for a rise in the standard of living and an increase in the per capita consumption of textiles to double the present figure. A sum of about 8 crores of rupees will probably represent the value of the chemicals and chemical products with which the dyestuff industry will be directly and indirectly concerned.

In 1941 the Government of India, on the recommendation of the Board of Scientific and Industrial Research, appointed an Exploratory Committee to consider ways and means for the manufacture of synthetic dyes. The terms of reference were (i) to make a rough survey of the consumption of the various kinds of dyes in India; (ii) to survey the raw materials and heavy chemicals available for the manufacture of dyestuffs in India; and (iii) to consider the practicability, both technical and economic, for the manufacture of such dyes in India as are capable of production within a period of 15 years.

While the range of dyes employed by our mills and for other purposes runs into hundreds, about 50% of our dye consumption would be represented by a comparately narrow range of 50 dyes. At the instance of the Dyes Committee the necessary raw materials for these 50 dyes, which could be regarded as the basis of a 15-year plan for the establishment of a dye industry, have

been examined (**J.Sc. Ind. Res., 1942-43 1, 298**), and data collected on their production in India. The survey disclosed that the raw material position was on the whole favourable, and further discussion with experts led to the conclusion that, provided certain conditions could be fulfilled, it was practicable to manufacture all the dyes in substantial demand in the country within a period of 15 to 20 years.

There are, however, many problems to be faced and solved. Among the coal tar raw materials, benzene and toluene are already available in quantities considerably larger than those required for the dyestuff plan, and in the case of toluene our production capacity is so large that we might think of additional outlets. The toluene now under production for defence purposes is of the same degree of purity as the dye industry requires. This is not true of benzene, but there is no special difficulty in manufacturing pure benzene. The present supply of naphthalene is inadequate, but it can be increased. The anthracene available is very much less than the needs of the dyestuff industry, but fortunately the anthracene dyes can be conveniently made by the phthalic anhyride route from naphthalene, and the total quantity of naphthalene, taking this additional figure into account, can be isolated from Indian coal tar.

Our coal resources are limited and they have to be conserved very carefully.

The inorganic heavy chemicals, consisting mainly of sulphuric, hydrochloric and nitric acids, caustic soda and soda ash, are over 90 per cent of the total raw material requirements. Although they are already being produced on a considerable scale, they are more or less full allocated to existing industries, and it it un likely that, with the possible exception of sulphuric acid, the dye industry will be able to draw on the present production. Further, the prices are much too high, and it will be necessary for the Indian dyestuff industry to include in its own programme the manufacture of such heavy chemicals as nitric acid by ammonia oxidation and sodium nitrite, as a by-product, oleum, and sodium sulphide. Except for alcohol, the aliphatic chemical industry has been undeveloped, and the manufacture of acetic acid and anhydride, synthetic methanol and formaldehyde must be planned, though the requirements for dyes will not justify their production by the dyestuff industry itself.

The plant requirements represent a serious problem and it will be necessary to import a considerable part of the plant, after taking the fullest advantage of engineering facilities in the country. We will have to develop ultimately a full-fledged chemical engineering industry capable of designing and producing all the machinery and equipment for the chemical industries including the special plant which can withstand the string-

ent conditions of corrosion, temperature and pressure involved in modern chemical processes; but the time factor is the primary consideration and the early establishment of dye manufacture must be made possible by entering into working arrangements with foreign manufacturers of plant. In view of the difficult and complex nature of the processes of dye manufacture, co-operation with one or more of the large and well-stablished dyestuff organisations in Europe or America will be desirable, so that their technical experience may be available to us. State aid would also be required in many forms and one may recall in this connection the steps taken by the British Government during the last war to safeguard the British dyestuff industry.

Research on synthetic dyes should have ample provision in the national programme of research. The leadership of Germany in the manufacture of dyes and medical chemical was mainly due to he far-sighted encouragement of research. Great Britain and America were not long in learning this lesson, and it has been computed that the American dye manufacturer spends over two million dollars per year on research, devoted not so much to the discovery of new dyes, which must necessarily become less frequent with the passing of time, but to continuous improvement in methods of production and plant design. The expenditure of the Imperial Chemical Industries in 1943 on research and development was over Rs. 3,00,00,000, and it is believed that this figure has now been considerably exceeded.

As a result of the visit of several British and American teams to Germany after the war, extensive and valuable information regarding dyestuff plants and processes in Germany has come to light. These are the subjects of publications issued by the Government of Great Britain and the U.S.A. The Government of India should arrange for copies of the entire set of publications to be supplied free of cost to the major technological institutions in the country, whose duty it will be to make them available to every one interested in the matter in the region concerned.

On account of the very difficult conditions of life in Germany today it is very likely that chemists and chemical engineers, with unique experience in the production of intermediates and dyes, will be prepared to come to India and to assist in the development of the Indian dyestuff industry. The possibilities in this direction must be immediately explored.

According to the reports in the press, Messrs. Tata Sons Ltd. and I.C.I. have arrived at an agreement for organising a dyestuff industry in India. It is understood that the project is proceeding as rapidly as could be expected, considering its vastness and its complexity. The industry will be so organised that it not only makes dyes, but constitute a comprehensive chemical industry, which would stimulate the growth of the entire organic chemical industry in India.

HEAVY CHEMICALS

Statement, summarising the recommendations and possibilities for the development of 'Chemical Industries.'

"REPORT ON THE DEVELOPMENT OF INDUSTRIES FOR WAR SUPPLIES"

BY DR. P. J. THOMAS

SULPHURIC ACID

Pre-war Production (1937):—There were 23 factories producing Sulphuric Acid, besides 6 others producing for their own consumption. Total production per annum was 30,000 tons.

Production during war-time (1943):—Production in the existing factories was increased by expansion, and six new factories also were established. Total production reached a figure of 93,000 tons.

Possibilities of Development:—With the all-round development of our industries like textiles, iron and steel etc., demand for the acid will increase. Production of Alum and Epsom salts, can be undertaken if the acid can be produced near the raw material deposits.

Location:—Since the main raw material Sulphur has to be imported, location will have to be fixed by considering the market. Ahmedabad, Bengal, Bihar, and U.P. each requires a ten-tons a day plant. Production of Alum in C.P. and Mag. Sulphate in Salem can be undertaken if sulphuric acid factories are established there.

Uses:—Sulphuric acid is a vital basic chemical. It is used in the production of auxiliary chemicals like alums, mag. sulphate, and acids like Nitric etc. More than 50% of the total production is consumed by other industries like textiles, steel and iron, etc.

Raw materials used and whether available in the country:—The raw material is Sulphur, supplies of which were met mainly by import. Rediscovery of sulphur deposits in Baluchistan could not ease the position greatly because of the low quality of Sulphur.

Remarks:—The present method of production by chamber process is antiquated. The more economical 'contact method' will have to be used. 'Contact plants' can be imported from U.S.A. Government can undertake a scheme for producing sulphur from gypsum.

CAUSTIC SODA

Pre-war Production:—Production in pre-war days was negligible and the whole of our demand was met by imports.

Production during war-time:—The 'Tata Chemicals' and 'Mettur Chemicals' have an estimated production of 10,000 tons per annum.

Possibilities of Development:—There are immense possibilities in regard to production of this chemical since the annual offtake of it comes to 50,000 tons. 4 or 5 plants each with a capacity of 10,000 tons per year can be established

Location:—Location of this industry will have to be determined by the (1) availability of cheap electric power, (2) proximity to the market. Caustic Soda plants can be installed in the following places to supply the industrialised area around them: (1) Bombay, (2) Bengal, (3) in the South near Malabar Coast.

Uses:—It is a key chemical used as raw material in the soap, textiles and paper industries. These industries account for 90% of the total consumption of alkali.

Raw materials used and whether available in the country:—The raw material is 'Common Salt' or Sodium Chloride. No dearth of it can be visualised, in India. Rock Salt in Punjab is also a source of this material.

CHLORINE

Pre-war Production:—Nil.

Production during war-time:—Both the factories producing caustic soda by the electrolytic method, get the chlorine as bye-product. 6,000 tons was the annual production in 1943.

Possibilities of Development:—If plants are established for the production of caustic soda, there will be increased availability of chlorine.

Location:—As for the alkali industry, since chlorine is a bye-product in the electrolytic manufacture of caustic soda.

Uses:—It is used in the manufacture of Bleaching powder and will be of great use in the 'Fine Chemical Industry' if developed. It enters into the manufacture of D.D.T. and Gammaxene.

BLEACHING POWDER

Pre-war Production:—Production in 1937 came up to 2,800 tons.

Production during war-time:—Bleaching powder is manufactured by both the factories producing caustic soda. Estimated production in 1943 was 4,200 tons.

Possibilities of Development:—Annual consumption of bleaching powder comes to 12,000 tons. With the increased availability of chlorine, indigenous production can be stepped up.

Location:—As for the alkali industry, since chlorine is a bye-product in the electrolytic manufacture of caustic soda.

Uses:—Used for sanitation purposes and in other industries.

Raw Materials whether available in the country:—Chlorine and slaked lime. Both of them are available in India.

SODIUM CARBONATE

Pre-war Production:— Nil.

Production during war-time:—There are 3 factories manufacturing Sodium Carbonate with a total estimated production of 74,000 tons per year.

Possibilities of Development:—Present Annual consumption is 100,000 tons and there are good prospects for the Soda Ash industry.

Location:—The location of the industry will be governed by factors such as (1) availability of raw materials, (2) proximity to the market.

Uses:—This chemical is much used in the glass and paper industry.

Raw materials used and whether they are available in India: The raw materials are salt, limestone, ammonia or its salt.

Remarks:—Sind, Bihar, South India, and C.P. each can have a new plant for production of soda ash.

SODIUM BICARBONATE

Pre-war Production:—Nil.

Production during war-time:—As an intermedite product in the soda-ash industry, one of the factories producing soda-ash, releases 1,500 tons annually.

Possibilities of Development:—Present annual consumption is 5,000 tons an indigenous production of Bi-carbonate can be stepped up.

Location:—The location of the industry will be governed by factors such (1) availability of raw materials, (2) proximity to the market.

Uses:—It is used in fire-extinguishers and medicinal preparations.

Raw materials used and whether they are available in India: The raw materials are salt, limestone, ammonia or its salt.

ALUMINIUM SULPHATE AND 'ALUMS'

Pre-war Production:—7,000 tons.

Production during war-time:—Production could not be increased due to shortage of sulphuric acid.

Possibilities of Development:—Demands for alums would increase with the expansion of our paper industry and textiles. Annual consumption would rise to 20,000 tons. With the possibility of increased production of sulphuric acid, the manufacture of alums in this country has bright prospects.

Location:—If a Sulphuric Acid plant can be established in C.P. or Rewa State, 'Alums' can be manufactured with the Bauxite available there.

Uses:—Mainly used for water-purification and in paper sizing. Potash Alum is used as mordant in dyeing and printing. Chrome Alum is used in chrome-tanning and khaki dyeing.

Raw Materials:—Bauxite and Conc. Sulphuric Acid. Bauxite is available in the Central Provinces and Conc. Sulphuric will have to be indigenously produced.

Remarks:—Pure Aluminium hydroxide, an intermediate product in the manufacture of Aluminium, is necessary for the manufacture of the purest variety of Aluminium sulphate.

POTASSIUM CHLORATE

Pre-war Production (1937):—Nil.

Production during war-time (1943): The Mettur Chemicals installed a plant with a production capacity of 300 tons per annum.

Possibilities of Develoment: Annual consumption being 1,500-1,700 tons, there is possibility for a scheme with the production capacity of 1,500 tons per annum.

Location:—Bombay has been chosen for locating the factory.

Uses:—Largely used in the match industry and to a little extent in blasting powder.

Raw Materials:—Potassium chloride and cheap electric power. Potassium Chloride is got as a bye-product in refining 'salt-petre'.

Remarks:—Both the factories at Bombay and Mettur can meet Indian requirements.

SODIUM SULPHIDE

Pre-war Production (1937):—Nil.

Production during war-time (1943):—A factory was established in Jodhpur with a capacity production of 3,000 tons. Since only two out of the 4 units are working, the production is 1,500 tons per year at present.

Possibilities of Development:—Since there is no great demand for sulphur colours, there is no possibility for an increase

in the demand for Sodium Sulphide. Hence the present capacity of the Jodhur factory will be enough.

Location:—Availability of cheap "Sodium Sulphate" is a factor which led to the location of the factory at Jodhpur.

Uses:—It is chiefly used in tanning industry and for developing Sulphur dyes.

Raw Materials:—Sodium Sulphate and coal.

POTASSIUM NITRATE OR SALT PETRE

Pre-war Production (1937):—7,000 tons.

Production during war-time:—The war did not stimulate the industry to any extent.

Possibilities of Development:—There are immense possibilities of development and an annual production of 50,000 tons can be reached.

Location:—The salt petre deposits are found largely in Bengal.

Uses:—Used in gun-powder and also as a 'manure'.

Raw Materials:—India holds the monopoly for Potassium Nitrate.

BICHROMATES

Pre-war Production (1937):—There was no production of bichromates in pre-war days.

Production during war-time:—When imports fell off during the war factories were started in Bihar and Mysore for the production of bichromates. There are now 12 factories producing Sodium Bichromate with a capacity production of 4,800 tons per annum.

Possibilities of Development:—The expansion during war-time is more than enough to meet our demands.

Location:—Good quality chrome ore is available in Bihar and Mysore and the factories have been located there.

Uses:—They are used in chrome-tanning and khaki dyeing. Chromic acid is produced from Bichromates. Potassium Dichromate is used in match industry.

Raw Materials:—Raw materials are quality chrome ore, Soda Ash, lime and Sulphuric Acid. Chrome ore is available in Bihar and Mysore.

Remarks:—Our annual consumption of bichromates in post-war period would come to 2,000 tons. A market can be found in Burma, Australia, and other adjacent countries for the spare capacity of 2,000 tons per year.

ACETIC ACID

Production in Pre-war days:—The wood distillation industry in Mysore was producing 200 tons of acetic acid annually.

Production during War-time:—Nil

Possibilities of Development:—There are immense possibilities for manufacture of this acid which is a raw material for the production of white lead, cellulose acetate etc.

Location:—Wood distillation plants can be installed near the source of supply of good wood.

Uses:—Used for the manufacture of lead acetate, white lead, cellulose acetate etc. Also it is used in the rubber industry.

Raw Materials:—One of the bye-products of the wood distillation industry. Ethyl alcohol can be oxidised to produce acetic acid.

Remarks:—Oxidation of alcohol for producing acetic acid can be undertaken in future when alcohol is in surplus.

ACETONE

Production in Pre-war days:—Nil.

Production during War-time:—The Government Cordite Factory was producing 700 tons of acetone from alcohol, to meet the war demands.

Possibilities of Development:—Nil.

Location:—Wood distillation plants can be installed near the source of supply of good wood.

Uses:—It is mainly used in the manufacture of explosives.

Raw Materials:—Acetone is a bye-product of the wood-distillation industry. Butyl alcohol is an important raw-material from which acetone can be produced cheaply.

FORMALDEHYDE

Production in pre-war days:—1937—Nil.

Production during war-time:—1943 — The Kirloskarwadi plant bought out by the Mysore Iron and Steel works is producing 60 tons per annum.

Possibilities of Development:—Being one of the raw materials in the production of Bakelite powder for the Plastic Industry, indigenous production of formaldehyde has good prospects.

Uses:—It is used in the manufacture of Bakelite powder and plastic glue. It is used in the prescriptions for tissue-preservatives.

Raw Materials:—Methyl alcohol which can be produced by distillation of wood or synthetically.

PHOTOGRAPHIC CHEMICALS—SODIUM THIO SULPHATE AND SODIUM SULPHATE

Production in pre-war days:—Nil.

Production during war-time:—Many small factories have started producing these chemicals during war-time. We shall be having a supply of 800 tons of Sodium Thio Sulphate and 300 tons of Sodium Sulphite per annum.

Possibilities of Development:—Nil.

Uses:—These ase photographic chemicals.

Raw Materials:—Soda Ash and Sulphur. Though Sulphur has to be imported, there will be no difficulty in regard to Soda Ash since 3 factories have started indigenous production of Soda Ash.

FERTILISERS

AMMONIUM SULPHATE

Production in pre-war days:—25,000 tons per annum.

Production during war-time:—The importance of fertilisers to step up production of food crops was recognised during the war-period and plans were formulated for the indigenous production of this important fertiliser.

Possibilities of development:—The fertiliser industry has to be developed, if agriculture is be rationalised. Ammonia can be produced synthetically and the other materials gypsum and coke are available in large quantities. An annual target production of 1,000,000 tons should be aimed at.

Location:—Availability of gypsum, good supply of coke and transport facilities, are all factors in determining the location of the factory.

Uses:—The most important manure, fixing-up nitrogen in the soil.

Raw Materials:—Ammonia and Sulphuric Acid. Due to shortage of the acid, the fertiliser can be produced by decomposing gypsum with Ammonia and carbon di-oxide. In this method of manufacture gypsum, coal and Ammonia are the raw materials.

Remarks:—A scheme for manufacture of this important fertiliser has been drawn up and the factory is to be set up at Sindhri in Bihar with an annual capacity of 350,000 tons.

SOAP INDUSTRY

Production in pre-war days:—Estimated production of soap in pre-war time was about 150,000 tons per year.

Production during the war-time:—Due to the difficulty in getting supplies of caustic soda, the industry suffered during war-time and the production fell to the figure 130,000 tons in 1945.

Possibilities of development:—The importance of soap as a consumer article is increasingly felt and the industry has good prospects for expansion.

Location:—Bombay and Calcutta areas have the main concentrations of the industry.

Raw Materials:—Oils, fats and resins and Caustic Soda. Certain Oils have to be imported and on expansion of the alkali

industry, there will be no great difficulty in obtaining supplies of Caustic Soda.

CEMENT

Production in pre-war days:—In 1939, production came up to 15 lakhs of tons.

Production during war-time:—During war-time the existing factories increased their production which came up to 20,00,000 tons.

Possibilities of development:—Industrialisation of the country, inauguration of irrigation and hydro electric schemes would all require a large amount of cement.

Location:—The industry is well-dispersed.

Raw Materials:—Limestone is the chief raw material. Coal, gypsum and clay are the other raw-materials of the industry.

Remarks:—The Government decided to have a target production of 6 million tons of cement per annum by 1952. The A.C.C. and Dalmias have plans of expansion and a new factory in Jamnagar with a capacity of 1 lakh of tons per year is contemplated.

INDUSTRIES BASED ON CHEMICALS

DRUGS AND MEDICINES

Production in pre-war days:—Drugs worth about 1,25,00,000 of rupees were produced in India.

Production during war-time:—Production increased and was able to meet the 66% of her annual demands, worth about 4 crores of rupees.

Possibilities of Development:—The industry is only in its infancy and there are immense possibilities of developments if the Heavy Chemical and Fine Chemical industries are developed and well established.

Raw materials:—Raw materials are

(1) Various inorganic chemicals
(2) synthetic fine chemicals
(3) vegetable and animal products
(4) coal-tar and wood distillation products
(5) fermentation products etc.

Remarks:—Government assistance and initiative are required in establishing this industry on a sound basis. The country should be made self-sufficient in regard to her requirements of drugs and fine chemicals.

PAINTS AND VARNISHES

Production in pre-war days:—Production in 1938 was estimated at 24,800 tons.

Production during war-time:—Estimated total production in 1942 was 30,000 tons.

Possibilities of Development:—If Industrialisation of the country is apace, there will be a large demand for paints and varnishes.

Location:—At present Bombay and Calcutta are the main centres of production.

Raw Materials:—The raw materials are various inorganic pigments, oils, resins etc. India is rich in most of the materials.

Remarks:—New plants in the Madras Presidency, U.P. and C.P. can be established with a capacity of 25,000 tons per annum.

REPORTS OF THE PANELS SET UP BY GOVERNMENT OF INDIA

SUMMARY OF THE FINAL REPORTS OF THE PANELS ON HEAVY CHEMICALS AND ELECTRO-CHEMICALS

A statement is attached summarising the recommendations of the Panels on Heavy Chemicals and Electro-Chemicals regarding targets and locations. The two Panels have throughout worked in close collaboration.

HEAVY CHEMICALS

2. The consumption of Heavy Chemicals depends on the development of the consuming industries, the exact extent of which is difficult to estimate. The Panel are of the opinion that while the targets suggested by them are based on a consideration of the existing conditions, Government may have to modify them suitably when implementing the recommendations, should changed conditions require it.

ELECTRO-CHEMICALS

3. There has been very little development of electro-chemical industries except for one or two areas. The Panel anticipate that with the completion of the hydro-electric projects, abundant power will become available and it will be possible to establish many electro-chemical industries.

GOVERNMENT DECISION

4. Government have decided that it is not necessary to lay down targets of production or to indicate where new units should be located.

The other recommendations are under examination.

PART I—HEAVY CHEMICALS

Name of Chemical.	Present annual production (in tons).	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations
Sulphuric Acid	59,000	55,760	152,600	Fifteen—10 tons per day units and one Govt. experimental plant for producing 35 tons of sulphuric acid and 12 tons of sulphur per day from gypsum should be installed in addition to one 35 ton per day plant in Madras and one 10 ton per day plant in Bihar. Balance of 23,600 tons to be allocated after location of rayon plants is decided. Cost of capital equipment: Rs. 37.5 lakhs without the Govt. plant. Location: New plants to be located in Sind, Bombay, Bihar and C.P. Foreign experts will be required for Govt. experimental plant. Indian students to go to U.K. and U.S.A. to specialise in Sulphuric Acid industry.
SULPHATES.				
Sulphate of Alumina.	10 to 17,000	20,500	38,000	Raw materials available in India. Protection should be given.

Magnesium sulphate	3,50,004,000	....	....	Can be increased if necessary.) Present production sufficient.
Iron Sulphate	2,000	....	....	—do—
Copper „	900	....	2,000	Possibility of manufacture from imported copper pyrites should be examined and the slender copper resources of India should be reserved for more important purposes.
Sodium Sulphate	2,000	....	4,000	No action necessary in view of large deposits of salt discovered in Jodhpur.
OTHER SULPHUR COMPOUNDS				
Sodium sulphide	....	3,700 (demand)	7,000	Jodhpur State who have a scheme for the manufacture of this chemical should be addressed to expedite its manufacture.
Sodium thiosulphate (type)	....	500 (demand)	....	No action as local manufacture will meet demand.
„ hydrosulphite (Hydros)	....	1,600 (demand)	2,500 3,000	As cheap Zinc and Sulphur dioxide necessary for manufacture of this chemical are not locally available, the possibility of developing alternative processes should continue to be investigated.

Name of Chemical	Present annual production. (in tons)	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations
ALKALI INDUSTRIES.				
Common Salt	....	....	....	To be supplied at low cost to chemical industries.
Lime	....	....	....	Installation of modern lime kilns in different areas should be undertaken by Provinces so that high grade lime may be supplied to sugar and other chemical industries.
Soda Ash	74,000 capacity, actual production much less.	107,500	270,000	Four new plants recommended —50,000 tons plants—one each in Sind and Bihar. 30,000 tons plants—one each in C.P. and South India. Foreign technical advice necessary. Indian Chemists and Engineers should go for training to U.K. and U.S.A.
Caustic soda.	12,600 (capacity)	54,000	133,000	One 11,000 ton mercury cell plant should be located in Bihar and others distributed in different parts of India: 30,000 tons of DDT and gammoxane should be manufactured from the chlo-

				rine produced and this should be aimed at as an eventual annual target. Government should employ experts to visit plants and give technical advice. Indian Chemical Engineers should be trained in U.K. and U.S.A. Such protection as will not penalise the consuming industries should be given.
Potassium chlorate.	2,000	2,000	....	A plant of 1,000-1, 500 tons should be installed in one of the alkali plants. Potassium chloride, the raw material, should be made purer.
Hydrochloric Acid	2,500	....	....	For any extra production required, manufacture from hydrogen and chlorine should be taken up.
Zinc Chloride	....	2,000 (imported)	....	Manufacture can be taken up only when cheap zinc residues become available in sufficient quantities.

Name of Chemical.	Present annual production (in tons)	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations
Magnesium chloride	....	7,000 (demand)	....	Manufacture more than sufficient—no action is necessary.
Calcium chloride	....	1,000	.. .	Present capacity more than sufficient to meet demand.
Potassium „	....	3,000 (imported)	....	Existing manufacture from bitterns and Reh deposits to be increased.
Barium chloride	. ..	....	....	1,000 to 1,500 tons per year should be manufactured in one of the alkali plants.
Nitric Acid	....	1,300 (demand)	4,000	Production in Ordnance Factories should be permitted to be utilised for civilian purposes.
Potassium Nitrate.	15,000	....	....	Indigenous production sufficient to meet the demand if the industry is organised properly.
Ammonia	1,500	....	....	No new plants are necessary but 12,000-15,000 tons of ammonia should be made available at a low price from one of the two plants that are being installed at Sindhri and Alwaye.

Ammonium chloride	Negligible	2,000 (imported)	4,000	No difficulty in achieving the target when soda ash manufacture is developed or when more hydrochloric acid becomes available from electrolytic chlorine.
Urea	....	....	10,000	A plant of 10,000 tons capacity per year should be installed at Sindhri.
Phosphates	....	....	100,000 super-phosphates	An experimental plant for manufacture of 10 tons of phosphorus per day and of concentrated phosphates by the electro-thermal process should be installed by Government
Calcium carbide.	....	7,000 (demand)	7,000	One 2,000-2,500 tons plant should be installed in South India, besides 5,000 ton plant in Bihar, for which import licence has already been granted.
Magnesia	....	500-600 (imports pre-war)	....	One firm has started production. No further action is necessary.
Arsenic oxide	....	250 (imported)	....	The Central State which has deposits should be approached by

Name of Chemical.	Present annual production (in tons)	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations
Borax	....	1,500 (imported)	....	Government to improve communications to enable the chemical to be brought into India cheaply. Borax resources should be exploited.
Dichromates	3,500	6,000 (demand)	....	Increased production not necessary and there is a danger of over-production. Production will probably be required.
Alcohol	....	....	....	A fraction of the production of 26 million gallons of alcohol recommended by the Sugar Panel should be made available for chemical industries at a very low price and free of duty.
Acetic acid	300 (capacity)	600-700 (imported)	....	Estimated demand 600-700 tons per year. No action is necessary since an import licence has been granted for a 2 ton per day plant.
Glycerine	2,500	....	....	No action is necessary. Production can be increased without difficulty when required.

Methyl Alcohol & Formeldehyde.	60	....	....	Manufacture should be taken up at Sindhri.
Acetone	1,000 (capacity)	....	....	Production by fermentation of molasses should be taken up.

PART II—ELECTRO-CHEMICALS

Hydrogen Peroxide	No production.	One plant of 350-400 tons capacity for which import licence has been granted is expected to be installed in Bombay. More plants should be installed when there is a definite demand. Mills that have electrolytic generator equipment should utilise them for the manufacture of hydrogen peroxide.
Carbon Disulphide		8760 tons per year required by the rayon industry should be prepared in the rayon factories themselves.
Artificial abrasives.		Mostly imported. Furnaces with a capacity of 2,000 tons for each of the abrasives, silicon, car-

Name of Chemical	Present annual production (in tons)	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations.
				bide and fused alumina, should be installed near a source of power.
Artificial graphite and electrodes.				Small quantities of carbon electrodes are being made at present in India. Government itself should instal one or two plants for manufacture of graphite electrodes if manufacture by the company started in Travancore does not materialise within a reasonable length of time.
Ferro-manganese.				Sandur State where the ore is available is considered suitable for manufacture of ferro-manganese in large quantities.
Ferro-silicon	2,000	4,000 (demand)	40,000 40,000	Mysore is planning production upto 4,000 tons per annum—no further action is necessary.
Aluminium	7,500 (capacity).		15,000-20,000	Another aluminium plant of 5,000 tons immediate capacity ultimately to be raised to 8,000

			to 10,000 tons should be installed near a source of power supply in addition to the two firms in India manufacturing aluminium. Special concessions, such as cheap transport and protection; should be given for the next five years after which the industry may be expected to stand competition.
Magnesium.	No production	negligible	Government should (i) install a small plant of 3-5 tons a day by the Pidgeon process, (ii) purchase and stock 1,000 tons of the metal for supply to Indian manufacturers at cost price.
Copper	6,000	10,000	Deposits of Jaipur, Sikkim, etc., should be examined in order to increase production. Copper pyrites should be imported to manufacture copper and sulphuric acid. One 5,000 ton unit for manufacture of primary metals from scrap should be establish-

Name of Chemical.	Present annual production (in tons)	Present annual consumption (in tons)	Five-Year Target (in tons)	Recommendations.
				ed at one of the sea port towns —scrap for this purpose should be imported free of duty.
Electro-plating.				Large plants for electro-plating industrial equipment should be installed.
Storage batteries.		75,000 Leatheries (imported)	100,000-125,000 Leatheries	The existing five factories can supply the requirements if reasonable protection is given.
Dry cells				Indigenous raw materials are not being used. This must be done after some processing if necessary. Possibility of manufacture on a cottage industry basis as in Japan should be examined.

SUMMARY OF THE REPORT OF THE PANEL ON FINE CHEMICALS, DRUGS & PHARMACEUTICALS

OBJECTIVE

1. The aim is to make the country self-sufficient in regard to fine chemicals, drugs and pharmaceuticals within the next fifteen years and to make all essential drugs available to the masses.

DEVELOPMENT OF THE INDUSTRY

2. Though the industry developed considerably during the present war, it is still in its infancy. Synthetic drugs produced in this country are mostly made out of imported chemicals and to place the manufacture of drugs and pharmaceuticals on a firm footing, it is of fundamental importance that fine chemicals should be produced in the country in requisite quantities.

RAW MATERIALS

3. The raw materials, from which drugs and fine chemicals are derived, consist of various inorganic chemicals, coal and wood distillation products, fermentation products, petroleum products, animal and vegetable products and synthetic chemicals derived from aliphatic chemicals. The panel consider that it should be possible to produce sufficient quantities of these materials in the country provided that (i) the Heavy Chemical Industry is expanded, especially the manufacture of chloro-sulphuric acid, sodium and chlorides of phosphorus, (ii) the manufacture of intermediates from the distillation products of coal is immediately taken in hand and (iii) the manufacture of adequate quantities of solvents and of crude vegetable drugs of proper quality is well organised.

FUTURE PRODUCTION AND TARGETS

4. The panel has fixed targets of production to be achieved within the next 10 years for about 100 different kinds of Drugs, Vitamins, Hormones, Liver Extracts, Insecticides, Refrigerating Chemicals, Photographic Chemicals, Fine Chemicals, Solvents and other miscellaneous articles. Amongst these, the panel considers that there are some essential items for which the need is very great and urgent and upon the production of which effort should be concentrated during the next five years. In

their view a start should be made with the production of these essential drugs and chemicals, utilising the raw materials already available in the country and importing those which are not at present available. In this way the country will be provided with a supply of the essential drugs from the very start at prices which will compare favourably with imported ones, and—what is equally important—a demand will also be created for basic chemicals, and thus an impetus given to their production in this country. The present production of these essential items and the targets to be achieved by the end of ten years are indicated in the table appended.

LOCATION

5. The Panel have made no specific recommendations regarding the location of this industry.

NATURE OF GOVT. ASSISTANCE REQUIRED

6. The Panel consider that the industry will require considerable assistance from Govt. and make a number of recommendations in this regard:—

(i) For the production of certain vital drugs such as Penicillin, Mepacrine and the Sulphanomides, the State should take the initiative and put up pilot plants. The State should also initiate production of coal tar intermediates either directly themselves or through private enterprise.

(ii) Protection should be afforded to this nascent industry; customs duty on raw materials, semi-manufactured goods and capital goods required for the industry should be remitted for 5 years; railway freights on the raw materials and on the finished goods should be reduced; and provincial excise rules should be rationalised so as to facilitate the movement of spirituous preparations from one part of the country to another.

(iii) Research on fundamental problems connected with the manufacture of fine chemicals, drugs and pharmaceuticals should be liberally subsidised.

(iv) Scientists and technicians should be trained for developing the industry in this country. Individuals should not be sent abroad for vague study, but only when some definite project has been decided upon and their specific function in it ascertained.

(v) The development of the fine chemicals, drugs and pharmaceutical industry depends to a great extent on the production of heavy chemicals, coal distillation products, and organic solvents etc., and the production of these materials is linked up not only with the drugs and fine chemicals industry, but also with the dye-stuffs, artificial fibre and plastic industries, etc. A carefully integrated plan is, therefore, required to be drawn

on the basis of the reports of several different panels and for this purpose Government should set up a Technical Planning Commission.

(vi) To put the Shark Liver Oil Industry on a firm footing, a Central Board, representing the relevant departments of the Government of India, the departments of Fisheries of the maritime provinces and non-official experts with a whole time executive, should be set up.

ORDERS OF GOVT.

7. The report has not yet been finalised and no orders have yet been passed by Government on it.

	Present Production	Target in 10 years
VEGETABLE DRUGS:		
Quinine	100,000 lbs.	2,000,000 lbs. per annum within 15 years.
Pyrothrum	(mainly imports)	50,000 tons of dried pyrothrum flowers per annum.
Emetin	(Imports)	2,000 lbs. per annum.
Strychnine	15,000 lbs.	16,000 „ „
Santonin	2,000 to 3,000 lbs.	3,000 „ „
Ephedrine	3,000 lbs.	5,000 „ „
Caffeine	20,000 lbs.	30,000 „ „
Morphine	Nearly 2,000 lbs.	3,000 „ „
SYNTHETIC DRUGS:		
Sulpha drugs.	(not known)	5,000,000 „ „
Mepacrine	„	160,000 „ „
Paludrine		Target not fixed.
D.D.T.	(Very little)	30,000 tons p.a.
P-carbamino Phenyl Arsonic acid (carbarsone).	2,000 lbs.	50,000 lbs. p.a.
Sulpharsphenamine and Neorasphenamine.	(Not known)	50,000 lbs. p.a.

ANTI-BIOTICS :		
Penicillin	nil	1,000,000 million units p.a.
Streptomycin	(not known)	As much as possible.
VITAMINS.		
Vitamin A	35,000 gallons	1,000,000 gallons of shark liver oil of potency 6,000 units per gramme.
Vitamin B (group)		Targets not fixed. The Technical and Planning Panels of the Food Dept. are dealing with this question.
" C		
" D		

SUMMARY OF THE DRAFT REPORT OF THE PANEL ON PLASTICS AND CELLULOID INDUSTRIES

I. PLASTIC INDUSTRY

PRESENT POSITION

1. The present world production of plastic is estimated at about 2,240 million lbs. annually. The **per capita** consumption in India in 1937 was 0.003 lbs. as compared to lb. 1.500, 1,450 lbs and 1.000 lb in Germany, U.S.A. and England respectively. India possesses the resources necessary for the production of the raw materials required for the synthetic plastic industry and has in addition an abundance of naturally occurring resinous materials. The Panel therefore feel that with the development of the chemical industry and the aid of extensive research and proper standardisation of products, it will be possible to establish a flourishing plastic industry. The consumption of plastic goods is bound to increase rapidly in the post-war period.
2. The industry should be developed on the following lines.

(a) IMMEDIATE EXPANSION OF THE PLASTIC MOULDING INDUSTRY.

TARGET OF PRODUCTION

The moulding of plastic articles has been successfully undertaken in India in recent years. There are at present 75 presses capable of handling about 2,000 tons of moulding powders per annum; but most of the presses are manually operated and out of date. The Panel recommend that the moulding industry should be expanded to use about 3,000 tons of moulding powders annually during the next five years and that modern types of automatic presses should be imported. They also give a long list of articles proposed to be manufactured e.g., combs, buttons, trays, etc.

LOCATION

Moulding plants may be located in any part of the country preferably near trade centres. A moulding plant utilising 100 tons of moulding powder per annum is considered a minimum economic unit under Indian conditions. Two Central Die making establishments should be set up, preferably at Bombay and Calcutta.

USE OF IMPORTED MOULDING POWDERS

For the present the industry will have to use imported moulding powders. The Panel recommend (with one dissentient) that the import duty on moulding powders should be reduced to 50% At present duty on finished plastic goods and moulding powders is the same viz: 90% which the Panel consider unsasticfactory.

ORGANISATION OF THE INDUSTRY

The Panel consider that the expansion of the plastic moulding industry can be left to private enterprise; but if private capital is not forthcoming to instal Die-making plants, Government should subsidise the undertaking.

(b) DEVELOPMENT OF THE MOULDING POWDER INDUSTRY IN INDIA.

TARGETS OF PRODUCTION

The production of the following synthetic plastic moulding powders should be started as soon as the basic chemicals required for their manufacture are available at economic rates and the demand is sufficiently large to justify the erection of an economic unit for each type:

(i) Phenol-formaldehyde (1500 tons).

(ii) Cellulose Nitrate (2,000 tons).

(iii) Urea-formaldehyde (500 tons).

(iv) Cellulose acetate (1,000 tons).

lene (5) Alkyd (6) Vinyl (7) Acrylate (8) Silicone.

For a long range industrial development plan the production of the following synthetic plastics should be undertaken.

(1) Melamine (2) Furfural-phenol (2) Nylon (4) Polyethy-

(c) DEVELOPMENT OF NATURALLY OCCURRING RESINS FOR USE IN THE PLASTIC INDUSTRY. There are bright prospects of developing the naturally occurring resins for use in the industry. Lac, Bhilawan, Cashew shell liquid, etc. are some of the most promising materials available in the country. Intensification of coordinated research on their utilisation is strongly recommended. A survey regarding the availability of Bhilawan, an important raw material for the plastic industry, should be undertaken.

(d) DEVELOPMENT OF THE FILLER INDUSTRY. A synthetic or a natural resin is very seldom in a condition suitable for direct moulding and requires the addition of filling materials. Wood flour is one of the most important of these. The Panel recommend that its manufacture should be undertaken in India and an annual production of 1,500 tons should be aimed at.

(e) RESEARCH.—The plastic industry should be developed in India with the aid of extensive research both of synthetic and naturally occurring materials. It is understood that the proposed National Chemical Laboratories of the Council of Scientific and Industrial Research are going to have a separate division for research on high polymers and plastics. The Panel is of the opinion that all problems of the synthetic plastic industry should be tackled by this section which should be fully equipped with modern apparatus and pilot plants etc. The proposed two cellulose Research Institutes, recommended by the Rayon Panel, should also deal with research problems of the plastic industry using cellulose raw materials.

(f) TECHNICAL TRAINING.—Government should send abroad two Indian technicians every year for training in die designing for the next five years.

II. RAW FILM MANUFACTURE

PRESENT POSITION

1. The Indian film industry claims to occupy one of the foremost places among the various industries in the country. The pre-war imports of motion picture raw film were about 80 million ft. per year. Consumption is likely to increase rapidly in the next few years.

POST-WAR TARGET

2. The Panel recommend that one factory manufacturing 50 million square feet of raw film of all types should be established during the next five year period.

STAGES OF DEVELOPMENT

3. They recommend that the development of the raw film industry should be in the following stages:—

(a) coating and processing of imported film base;
(b) manufacture of film base in the country using imported chemicals;
(c) manufacture of the necessary chemicals required in the country.

LOCATION

4. The Panel is of the opinion that a site near Poona is likely to be suitable for setting up a raw film factory. It is, however, felt that the actual selection of a site should be left to foreign technical experts.

OTHER IMPORTANT RECOMMENDATIONS

5. (i) FOREIGN COOPERATION:—Since the raw film manufacture is a highly technical and specialised industry and the processes of manufacture employed are patented secrets of a

selected number of foreign manufacturers, co-operation with some reputed foreign manufacturers is considered essential. The Panel are of the opinion that the Government should take the initiative in this direction and arrange with some foreign firm in the U.S.A., Germany or Belgium for help and assistance in establishing the industry in India. For this purpose it may be necessary to sponsor a joint venture with foreign manufacturers.

(ii) GOVERNMENT ASSISTANCE:—The Panel recommend that the Government should give adequate protection to the industry in the form of subsidy, bounties or by any other means which will not adversely affect the motion picture producing industry. In view of the fact that the industry will use imported chemicals in the initial stages, the Panel feel that the import of the chemicals used specially for raw film manufacture should be allowed duty free. The draw-back rebate system is recommended as suitable for this purpose. The Panel further recommend that concessional railway rates should be fixed for the movement of raw materials required by this industry and its finished products.

(iii) TECHNICAL TRAINING:—The Panel recommend that the Government should arrange to send at least 20 young Indians abroad for specialised training in raw film manufacture. They should be trained for a period of two years in factories manufacturing raw films.

6. The report is being finalised.

SUMMARY OF DRAFT REPORT ON PAINTS AND VARNISHES

There are at present 38 paint factories, of which 15 are large and well established, and 5 pigment and colour manufacturers. The various products of the industry may be classified as under—

(i) Paints and enamels,

(ii) Varnishes and lacquers, and

(iii) Pigments.

The first two constitute finished products, whereas pigments are more in the nature of raw materials both for the paint industry itself and for other industries. Other raw materials employed by the industry, besides pigments, may be grouped as—

(a) Drying oils and Driers

(b) Solvents and Thinners

(c) Resins and synthetic resins.

With the exception of synthetic resins all of these are available in India in the required quantities.

TARGET OF PRODUCTION

2. The existing production and the proposed targets in respect of the various products of the industry are shown in the statement below.

Products	Existing production.	Targets.	Remarks.
(1) Paints & Enamels.	50,000 tons	100,000 tons.	50% of the proposed increase is to meet the increased demands of the internal market & the balance for export.
(2) Varnishes (all types)	25 lakhs gals.	No target proposed.	
(superior quality)	135,000 gals.	300,000 gals.	
(3) PIGMENTS.			
(a) ZINC PIGMENTS Lithopone	—	5,000 tons	Estimated present requirement is 4,000 tons.
Zinc Oxide	4,000 tons	6,000 tons	The increased targets of 8,000 tons is recommended if Lithopone manufacture is not developed.
(b) LEAD PIGMENTS White lead, Red lead, Litharge & Lead chrome.	4,500 tons	8,000 tons	Mainly manufactured from imported lead as Indian sources of production of lead are negligible.
(c) TITANIUM WHITES.	—	3,000 tons	Titanium—containing mineral deposits are available in large quantities in Travancore State.
(d) Carbon Black	Nil.	500 tons	About 400 tons per year are imported for use in paint, rubber and other industries.

Products	Existing production.	Targets.	Remarks.
(e) Aluminium powder	250 tons (requirements not known)	500 tons	
(f) Mercuric oxide & cuprous oxide		500 tons	
(g) OTHER PIGMENTS. Barytes, Whiting, Gypsum, Bauxite, China Clay, Mica, Silica, Red Ochres, Iron reds, Ochres & Siennas, Yellow Chromes, Yellow Oxide of Iron, Cadmium yellow, Terre Verte or Green Earth, Chrome Green or Brunswish Green, Chromium Oxide, Ultramarine Blue, Prussian Blue, Graphite and Lake Pigments.			These are the other pigments used in the Paint industry. Most of them are available in India in large quantities and hence no targets are suggested by the Panel.

LOCATION

3. The Panel recommend that the extra production of 50,000 tons of paints and enamels should be achieved by increasing the capacity of the existing plants by 25,000 tons and by installing new plants of a capacity of 25,000 tons. For the new plants 5 tons per day units are considered suitable. 15 such units are necessary and the Panel have made proposals for the distribution of 12 of these as follows:—

South India including Madras Presidency and the State of Hyderabad, Mysore, Travancore and Cochin etc.	15 tons per day.
United Provinces	15 „ „ „
Central Provinces, Bihar, Assam, Orissa, Sind and N.W.F.P.	5 „ „ „ for each province.

The Panel have recommended that no new plant should be installed in Bengal, Punjab and Bombay since the industry is already concentrated in these Provinces. There is, however, to be an expansion of existing plants by 25,000 tons and a good portion of this will go to these Provinces.

RECOMMENDATIONS REGARDING GOVT. ASSISTANCE & ORGANISATION

4. The Panel have made the following recommendations for increasing the scope and efficiency of the industry.

(i) A Central Association of all paint manufacturers should be formed to advise Govt. periodically on the development of teh industry and the controls to be exercised. Membership should be made compulsory.

(ii) A Central Paints Laboratory should be started by Government in consultation with the industry. This laboratory should also be a training centre.

(iii) 10 technicians should be sent abroad annually for specialised studies, and arrangement should be made to import German technicians on a 3 years minimum contract.

(iv) A number of measures should be taken to encourage the production in India of various pigments (more especially Titanium Whites from titanium-containing deposits in Travancore) and synthetic resins. As most of the pigments belong to the class of minerals about which full information is not available, the Geological Survey of India should pay special attention to this matter.

5. The report is being finalised and Government have not yet passed any orders on it.

APPENDIX I

Questionnaire of the N.P.C. report.

List of questions that can be attached to the Report of the 'Chemical Industries Sub-Committee'.

As most of the questions are of a general type, and have been brought under the 'Manufacturing Industries Sub-Committee's Report, no attempt has been made to include them in this list.

LIST OF QUESTIONS.

Hand Book No. 1
Page No. 19
Q. No. 13

Are there any key industries in your province?

N.B.—By "Key Industries" is usually meant industries which are the starting point of the basis of other industries."

Q. No. 14

How far as heavy industries already in existence in your Province, and to what extent do these industries compete with corresponding industries within the country, or outside the country ?

N.B.—By "Heavy Industries" is usually meant industries concerned in the manufacture of iron and steel and their products, engineering, chemicals and their like."

Q. No. 15

What room is there for the further development of these Heavy Industries in your Province, and what steps would you suggest for achieving that end?

.. List of Questions that can be attached to the Report of the..

'Chemical Industries Sub-Committee.'

Hand Book No. 1

Page No. 20 (c) Mineral

Q. 23 What are the chief mineral resources available in your Province ? How far are these resources already being exploited, and developed and by what agency ?

Q. 24 What is the room for large-scale mineral, or metallurgical industries in your Province?

Q. 25. What is the policy of Government in your Province in regard to the grant of concession for the exploitation of mineral wealth in your Province?

Q. 27 What agencies,—local, Indian, or non-Indian—exploit the mineral resources of your Province, under what form of organisation and on what scale of production?

Page No. 22. V. Agriculture (Fertilisers).

Q. 44 What are the handicaps which affect the maximum utilisation of the available agricultural wealth and resources of your Province in regard to:—

(c) Manure

Q. 46 How far does the yield per unit of area cultivated for different crops within your province compare with the corresponding yield per unit of the same crops in

(a) the other provinces of India
(b) in the other countries of the world?

What steps would you indicate to improve the quality as well as the quantity of this yield?

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SUPPLEMENTARY QUESTIONNAIRE

Q. 1. Has there been ever any attempt to manufacture in this country any of the following articles at present imported?

Table I.

No. 9 Chemicals and chemical preparations

(a) acids:
Acetic
Carbolic
Citric
Hydrochloric
Nitric
Oxalic
Sulphuric
Tartaric
other sorts.
(b) Alum
(c) Aluminous sulphates
(d) Ammonia and its Salts;
Anhydrous ammonia
Ammonium Carbonate and bicarbonate
Ammonium chloride
other ammonium salts

(e) Arsenic and its oxides
(f) Bleaching materials
Bleaching powder
other kinds
(g) Calcium carbide
(h) Calcium chloride
(i) Chlorine, liquid
(j) Copperas (Ferrous Sulphate)
(k) Copper Sulphate
(l) Disinfectants:
Naphthalene
other kinds.
(m) Glycerine
(n) Lead compounds:
Acetate
Litharge
others
(o) Magnesium compounds
Chloride
Sulphate
Others
(p) Phosphorus, all kinds
(q) Potassium compounds
Bichromate
Chlorate
Cyanide
others sorts
(r) sodium compounds
Bicarbonate
Bichromate
Borax
Cyanide
Carbonate
Caustic Soda
Hydrosulphite
Silicate
Sulphate
Sulphide
other salts
(s) Sulphur.
(t) Zinc Compounds:
Chlorides
Others.
(u) other sorts of chemicals.

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12) DRUGS AND MEDICINES.
a) Camphor
b) Cocaine

c) Cod-Liver Oil
d) Morphia
e) Preparations of Opium and Morphia
f) Quinine salts.
g) Saccharine.
h) other sorts of drugs.

14) DYEING SUBSTANCES.

b) Cochineal.
c) Cutch and gambiar.
d) Dyes from coal-tar.
A) Alizarine.
Dry
Not exceeding 40%
Exceeding 40%;
Moist
Not exceeding 16%
Exceeding 20%.
Over 16% but not exceeding 20%.
B) Congo red.
C) Congo red.
Coupling dyes of the naphthol group
Naphthols:
Rapid fast colors (rapid salts)
Bases;
Other salts,
D) Vats:
Indigo;
Carbazole blue;
other sorts,
Paste;
Powder;
E) Metanil Yellow,
F) Sulphur Black.
G) Auramine of Concentration of 15% and less.
H) Rhodamines (Carthamines) of conc. of 15% and less.
I) Aniline salts.
J) Other sorts.

26) MANURES:

a) Nitrogenous,
A) Nitrate of soda
B) Sulphate of Ammonia
C) Others.
b) Potassic
A) Muriate of Potash
B) Others

c) Phospatic
   A) Super Phosphates
   B) Others
d) Compounds
   A) Ammonium phosphates
   B) Fish Manures
   C) Others

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31) PAINTS AND PAINTERS' material (a) Paints & Colours.
   (A) Barytes.
   (B) Blue paint or Paris blue
   (C) Graphite
   (D) Red Lead
       Genuine dry;
       Reduced dry
   (E) White Lead
       Genuine dry;
       Genuine moist
   (F) Lithophone
       Dry
       White moist
   (G) Zinc white
       Genuine dry;
       Genuine moist
   (H) Other Sorts
       White dry;
       Coloured dry;
       White moist;
       Coloured moist.

(b) Painters' materials (Other than paints and colours)
   (A) Turpentine
       Genuine
       Substitute
   (B) Varnishes
       Enamels
       Lacquers;
       other kinds
   (C) Other kinds of painters' materials.

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Q. 2 What steps have the various departments of Industries taken from time to time to draw public attention to these items and have them manufactured here?